Exhibit A

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Liu

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(54) **ELECTRONIC CIGARETTE AND METHOD FOR MANUFACTURING ATOMIZING ASSEMBLY THEREOF**

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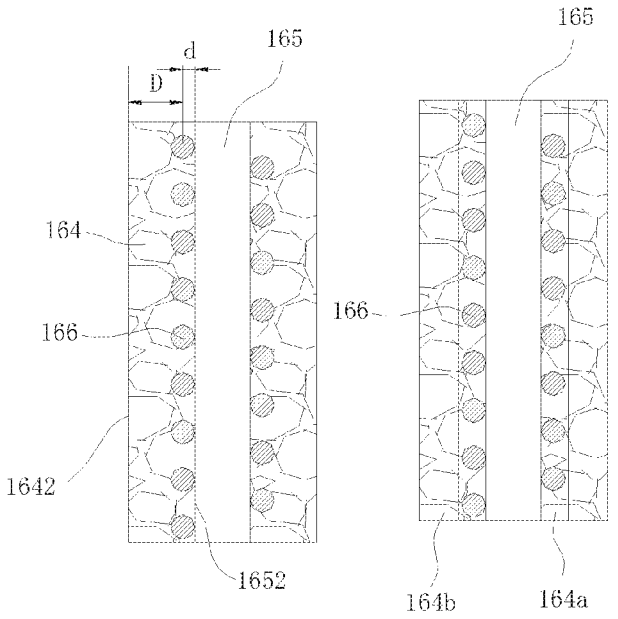
(57) **ABSTRACT**

An electronic cigarette and a method for manufacturing an atomizing assembly thereof. The electronic cigarette comprises a liquid reservoir used for storing an e-liquid, and an atomizing assembly received in a shell. The atomizing assembly comprises: a liquid-absorbing element connected to the liquid reservoir, wherein the liquid-absorbing element is made of porous ceramic, and has a liquid-absorbing surface for absorbing the e-liquid and an atomizing surface; and a heating element embedded in the liquid-absorbing element, wherein the edge of the heating element is internally tangent to the atomizing surface, and the heating element is used for converting the e-liquid absorbed by the liquid-absorbing element into smoke. The electronic cigarette further comprises a power supply assembly received in the shell, connected to the atomizing assembly, and used for supplying power for the heating element.

14 Claims, 13 Drawing Sheets



(51) **Int. Cl.**

A24F 25/00	(2006.01)
A24F 47/00	(2020.01)
A61M 15/06	(2006.01)
A61M 11/04	(2006.01)

(58) **Field of Classification Search**
USPC 131/329
See application file for complete search history.

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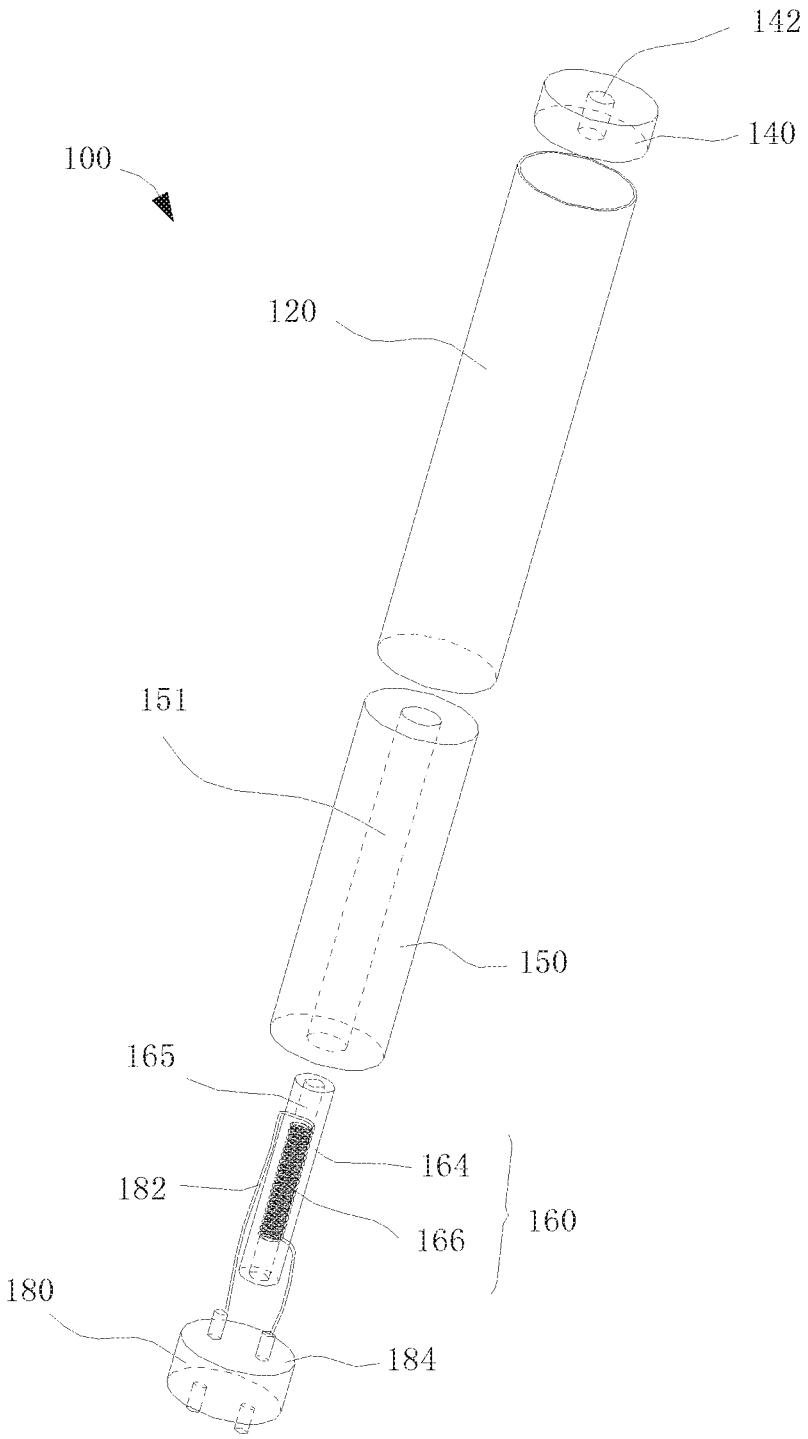

FIG. 1

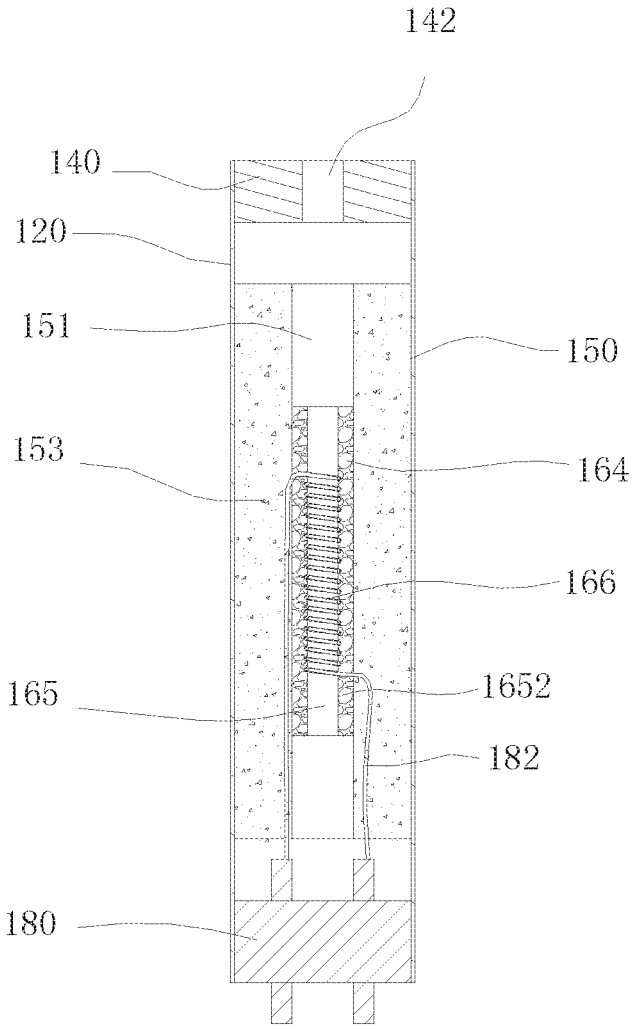

FIG. 2

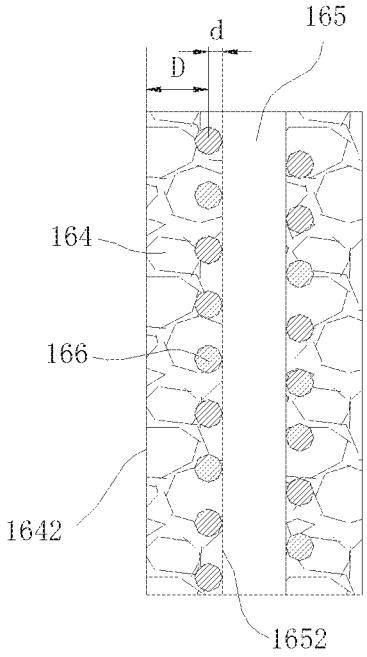

FIG. 3A

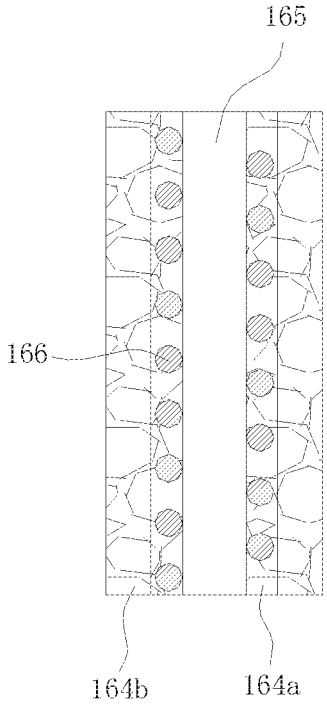

FIG. 3B

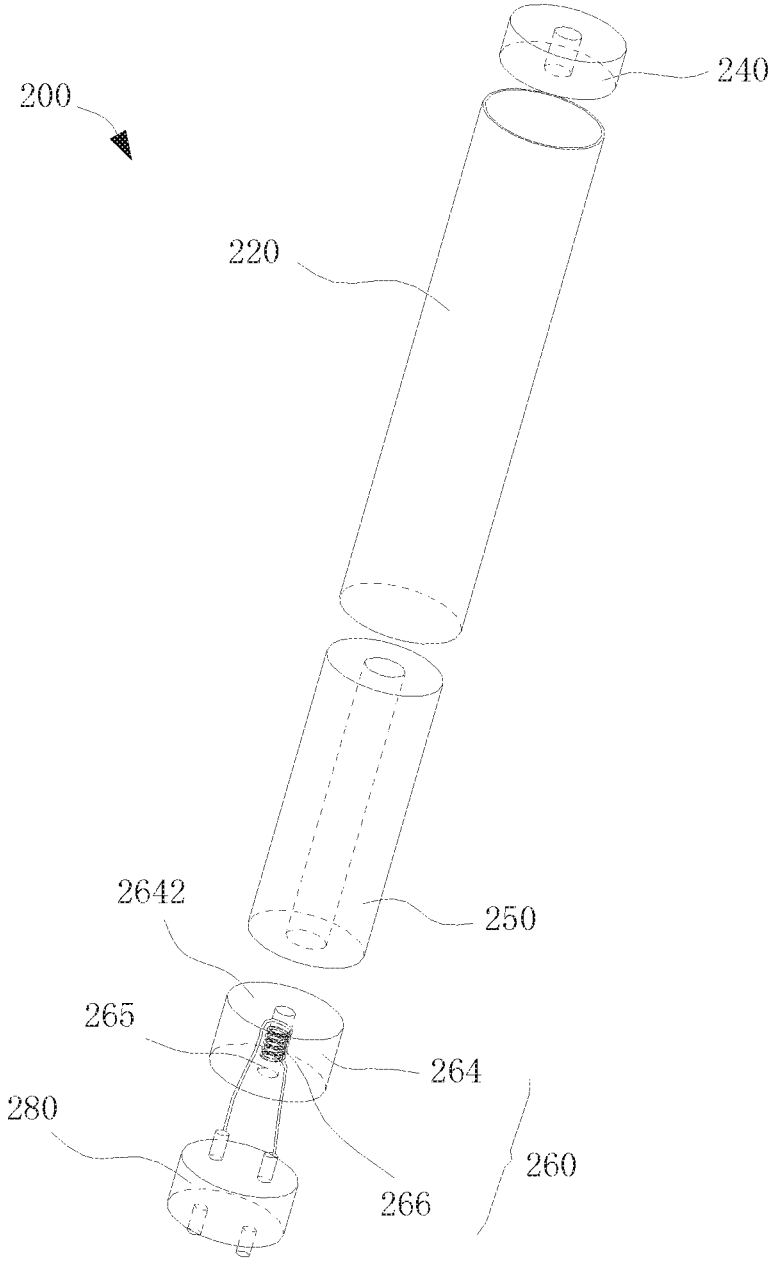

FIG. 4

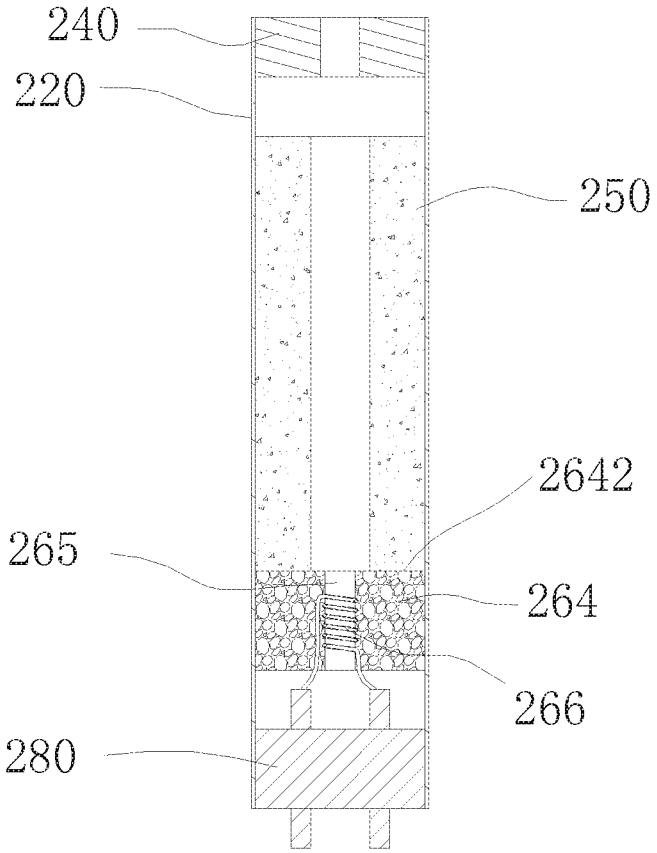

FIG. 5

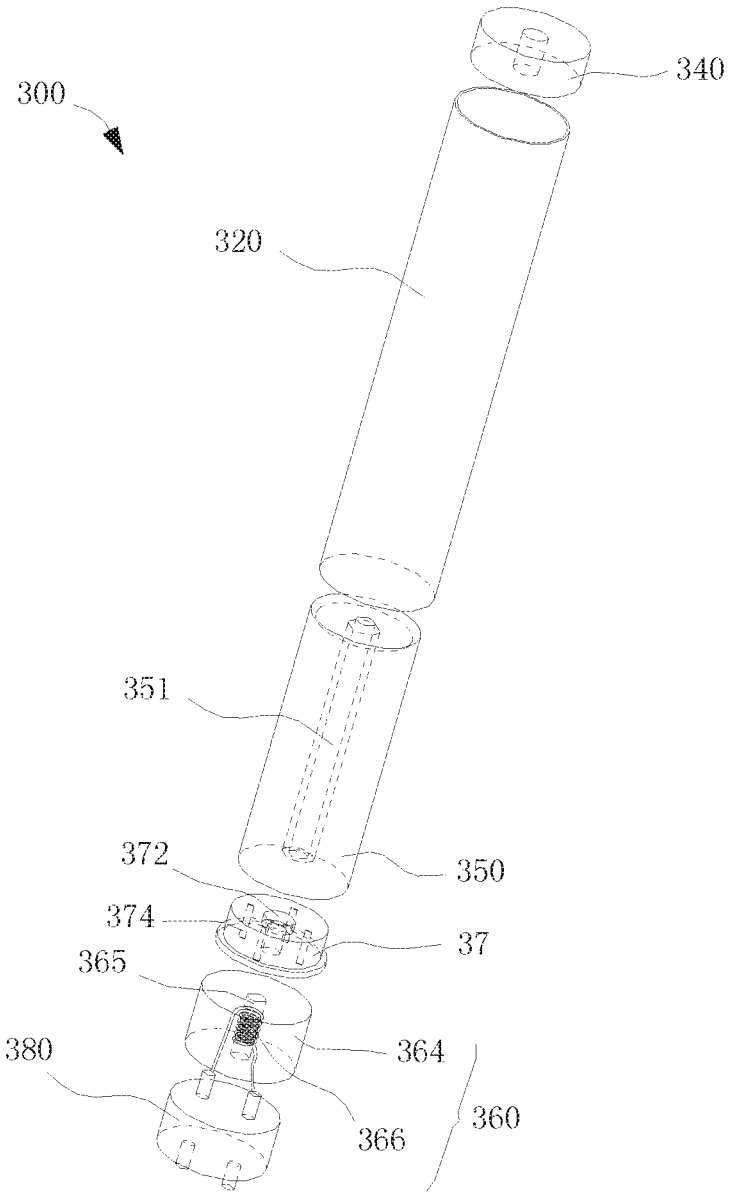

FIG. 6

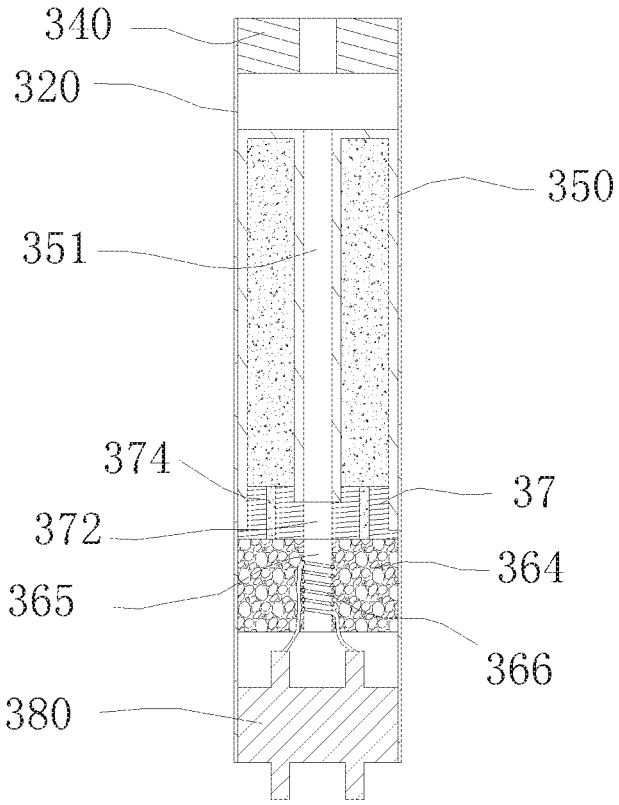

FIG. 7

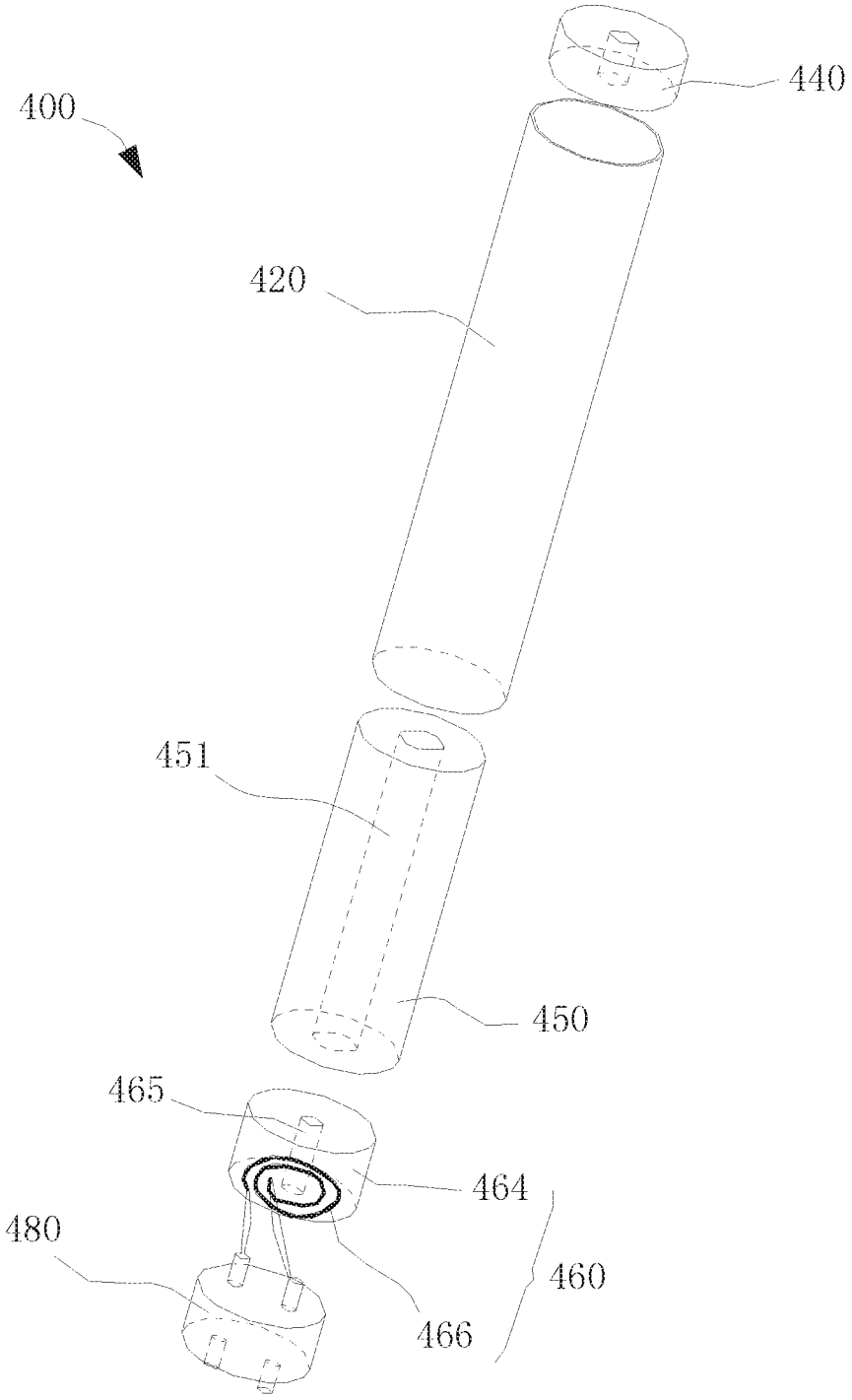

FIG. 8

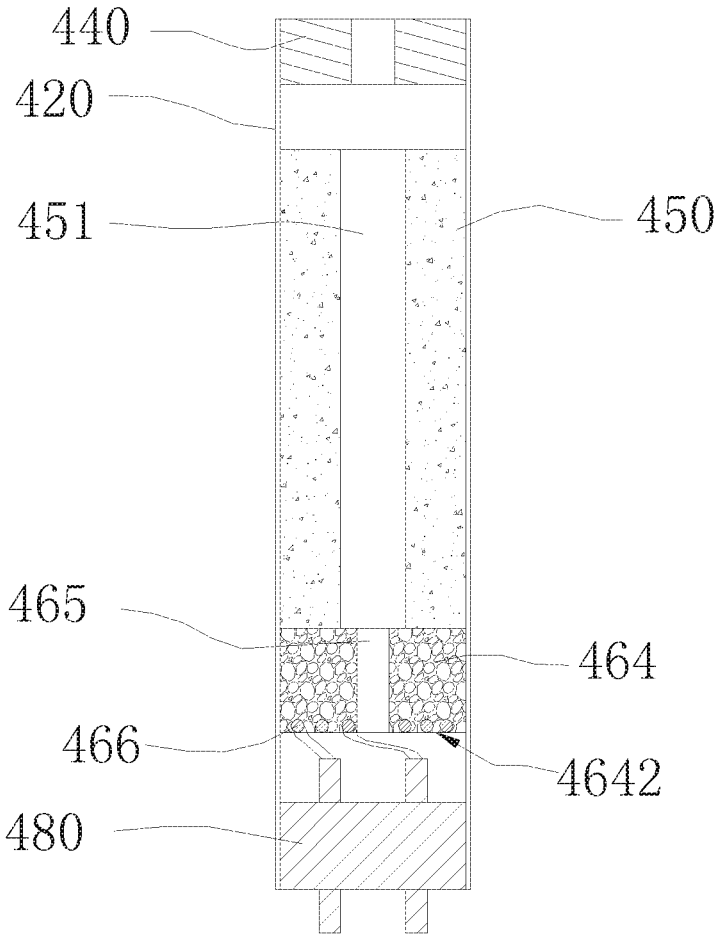

FIG. 9

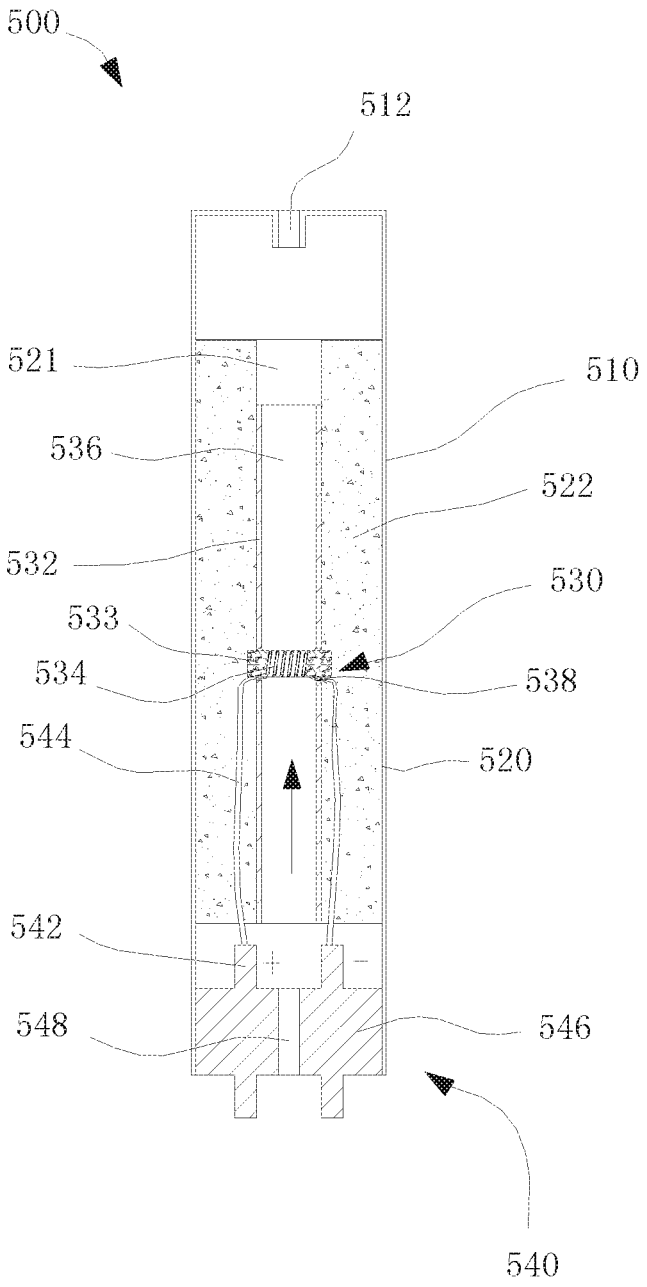
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FIG. 10

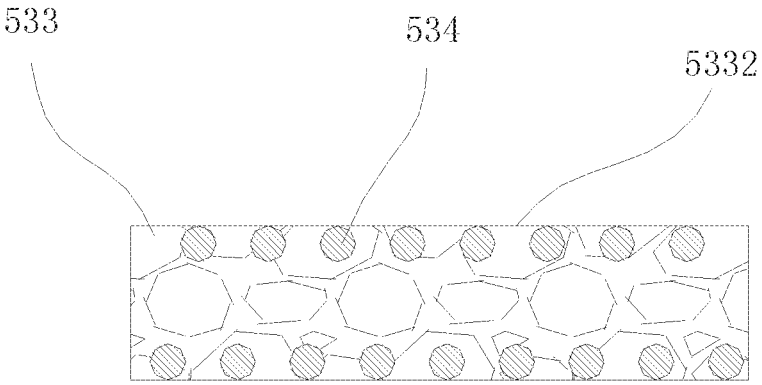

FIG. 11

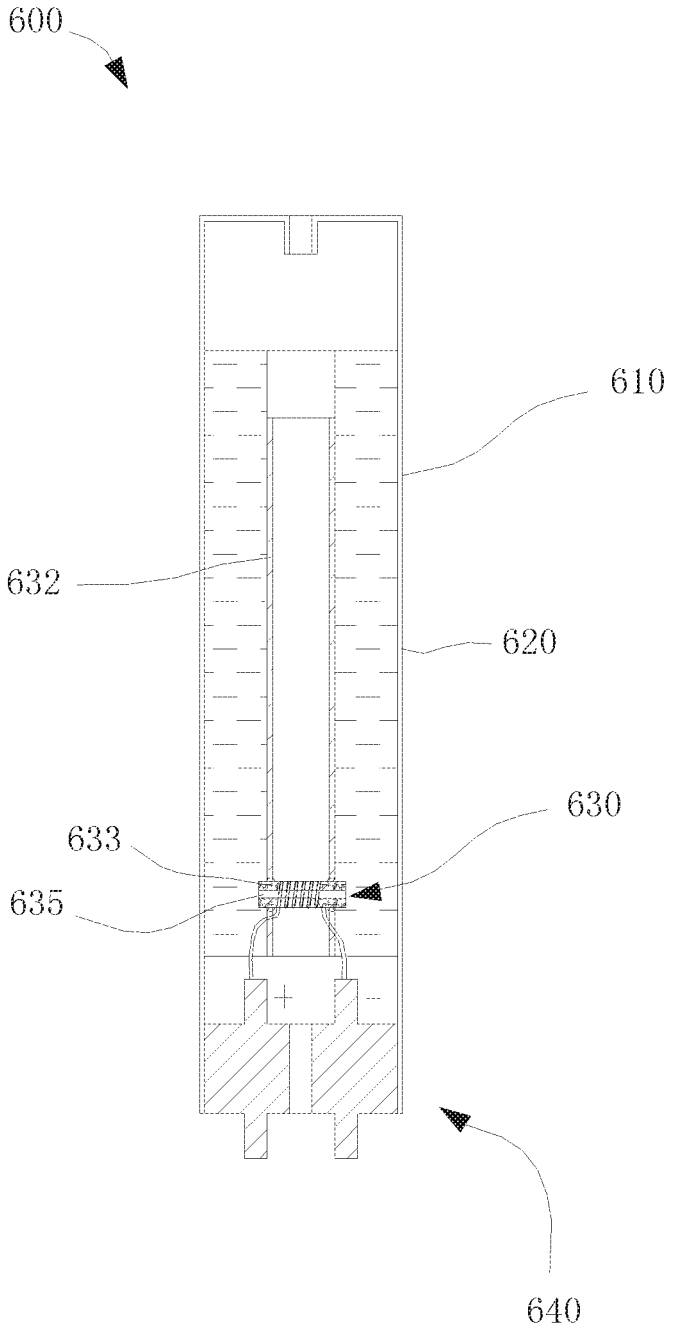

FIG. 12

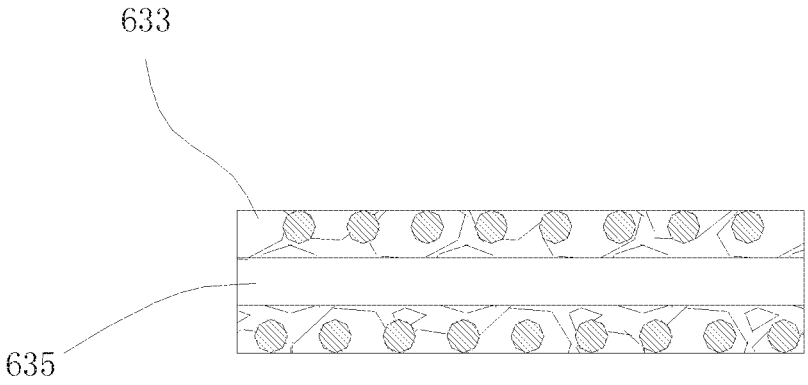

FIG. 13

ELECTRONIC CIGARETTE AND METHOD FOR MANUFACTURING ATOMIZING ASSEMBLY THEREOF

FIELD OF THE INVENTION

The present disclosure relates to an electronic cigarette and a method for manufacturing an atomizing assembly thereof.

BACKGROUND OF THE INVENTION

Electronic cigarette, also known as virtual cigarette or electronic atomizers, is a substitute of the cigarette for smoking cessation. The electronic cigarette has a similar appearance and taste as the cigarette, but it generally does not contain other harmful ingredients in the cigarettes, such as tar, suspended particles, and so on.

The electronic cigarette is usually composed of an atomizer and a power supply assembly. The atomizer is a core unit of the electronic cigarette for generating an atomizing gas, and its atomization effect determines the quality and taste of the smoke. A conventional heating element of the atomizer is a spring-like heating wire, which is fabricated by winding a linear heating wire around a wick. The smoking liquid in the liquid storage device is adsorbed to the wick through both ends of the wick and then heated and atomized by the heating wire. However, the liquid of this type of electronic cigarette is completely absorbed by both ends of the wick and then atomized. Due to the limited area of the end of the wick, the adsorption efficiency of the liquid is quite low. Therefore, when a high power heating wire is used, there will be inadequate liquid supply to the wick, thus resulting in dry burning as well as production of a burning smell.

To address the aforementioned inadequate liquid supply issue, the improvement in the prior art is that the helical heating wire is externally coated with a liquid guiding structure such as liquid guiding cotton, such that the whole sidewall of the liquid guiding cotton can be used to conduct liquid, thus providing adequate liquid supply. However, this approach suffers from some problems, such as: 1) a popping sound by the liquid is often produced, and 2) the atomizing efficiency is low, i.e., the amount of atomized smoke is relatively small at the same power.

SUMMARY OF THE INVENTION

Accordingly, it is necessary to provide an electronic cigarette with a better atomizing effect.

An electronic cigarette includes:

a liquid reservoir configured to store liquid;

an atomizing assembly received in the housing, the atomizing assembly comprising:

a liquid absorption element connected to the liquid reservoir, the liquid absorption element being made of porous ceramic, and the liquid absorption element having a liquid absorption surface configured to absorb the liquid, and an atomizing surface; and

a heating element embedded in an interior of the liquid absorption element, wherein an edge of the heating element is internally tangent to the atomizing surface, and the heating element is configured to atomize the liquid absorbed by the liquid absorption element into atomized gas; and

a power source assembly received in the housing and connected to the atomizing assembly, the power source assembly being configured to provide power for the heating element.

A method of manufacturing an atomizing assembly includes:

providing a positioning element, the positioning element comprising a positioning post;

winding a heating element spirally around the positioning post:

placing the positioning post wound with the heating element into a mold, injection molding a first layer of ceramic material on a surface of the heating element and then curing;

removing the positioning post from the cured first layer of ceramic material; and

sintering the cured first layer of ceramic material, thus obtaining a liquid absorption element made of porous ceramic and a heating element embedded in an interior of the liquid absorption element.

An electronic cigarette includes:

a liquid reservoir received in the housing and configured to store liquid;

an atomizing assembly received in the housing, the atomizing assembly comprising:

a support element defining an atomizing passage therein, the support element defining two aligned through holes on a sidewall thereof in communication with the atomizing passage;

a liquid absorption element made of porous ceramic, wherein both ends of the liquid absorption element extend through the through holes and extend inside the liquid reservoir, the liquid absorption element having a liquid absorption surface configured to absorb the liquid and an atomizing surface located inside the atomizing passage; and

a heating element embedded in an interior of the liquid absorption element, wherein an edge of the heating element is internally tangent to the atomizing surface, and

a power source assembly received in the housing and connected to the atomizing assembly, the power source assembly being configured to provide power for the heating element.

Compared with the prior art, the heating element is completely embedded in an interior of the liquid absorption element, while the liquid absorption element made of porous ceramic is full of liquid, therefore, the heating element is in complete contact with the liquid and achieves a better atomizing effect.

BRIEF DESCRIPTION OF THE DRAWINGS

The above objects, features and advantages of the present invention will become more apparent by describing in detail embodiments thereof with reference to the accompanying drawings. The components in the drawings are not necessarily drawn to scale, the emphasis instead being placed upon clearly illustrating the principles of the present disclosure. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the views.

FIG. **1** is a perspective exploded view of an electronic cigarette according to a first embodiment;

FIG. **2** is a cross-sectional view of the electronic cigarette of FIG. **1**;

FIG. **3**A is an enlarged cross-sectional view of an atomizing assembly according to an embodiment;

FIG. **3**B is an enlarged cross-sectional view of an atomizing assembly according to another embodiment;

FIG. **4** is a perspective exploded view of an electronic cigarette according to a second embodiment;

FIG. **5** is a cross-sectional view of the electronic cigarette of FIG. **4**;

FIG. **6** is a perspective exploded view of an electronic cigarette according to a third embodiment;

FIG. **7** is a cross-sectional view of the electronic cigarette of FIG. **6**;

FIG. **8** is a perspective exploded view of an electronic cigarette according to a fourth embodiment;

FIG. **9** is a cross-sectional view of the electronic cigarette of FIG. **8**;

FIG. **10** is a perspective view of an electronic cigarette according to a fifth embodiment;

FIG. **11** is an enlarged cross-sectional view of an atomizing assembly of FIG. **10**;

FIG. **12** is a perspective view of an electronic cigarette according to a sixth embodiment; and

FIG. **13** is a cross-sectional view of the electronic cigarette of FIG. **12**.

DETAILED DESCRIPTION OF THE EMBODIMENTS

The above and other features of the invention including various novel details of construction and combinations of parts, and other advantages, will now be more particularly described with reference to the accompanying drawings and pointed out in the claims. It will be understood that the particular method and device embodying the invention are shown by way of illustration and not as a limitation of the invention. The principles and features of this invention may be employed in various and numerous embodiments without departing from the scope of the invention.

It will be understood that when an element is referred to as being "connected" or "coupled" to another element, it can be directly connected or coupled to the other element or intervening elements may be present. In contrast, if an element is referred to as being "directly connected" or "directly coupled" to another element, there are no intervening elements present. Additionally, the words "herein," "above," "below" and words of similar import, when used in this application, shall refer to this application as a whole and not to any particular portions of this application.

Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

Referring to FIG. **1** and FIG. **2**, an electronic cigarette **100** in accordance with a first embodiment includes a housing **120**, a mouthpiece **140**, a liquid reservoir **150**, an atomizing assembly **160**, and a power source assembly **180**.

The housing **120** is substantially a hollow elongated cylinder. The mouthpiece **140** is located at an end of the housing **120**, and the atomizing assembly **160** and the power source **180** are received inside the housing **120**. It is to be understood that, the housing **120** may have other shapes, such as rectangular or the like.

The mouthpiece **140** has thread on its outer periphery, and the mouthpiece **140** is threadedly fixed at the top of the

housing **120**. The mouthpiece **140** defines an air outlet **142** at a center thereof. It should be understood that, the mouthpiece **140** can be omitted.

The liquid reservoir **150** is substantially a hollow circular tube and is mainly used for storing liquid. The liquid reservoir **150** internally defines a substantially cylindrical channel **151** along an axial direction thereof. The channel **151** is aligned with the air outlet **142**. The liquid reservoir **150** is filled with a storage medium **153** for storing liquid. The storage medium **153** can be made of fibers, preferably modified fibers, which can remove the odor of the liquid, so as not to affect the taste of the smoke.

The atomizing assembly **160** includes a liquid absorption element **164**, and a heating element **166**.

The liquid absorption element **164** is connected to the liquid reservoir **150**. In the illustrated embodiment, the liquid absorption element **164** is shaped as a tube matching with the channel **151**. Accordingly, the liquid absorption element **164** can be inserted into the channel **151** of the liquid reservoir **150** and be in direct contact with the storage medium **153**. The liquid absorption element **164** is made of porous ceramic material with liquid storage and heat-resisting features. Accordingly, the liquid from the storage medium **153** can be uniformly dispersed in the interior and surface of the liquid absorption element **164** by capillary action. The porosity of the porous ceramic forming the liquid absorption element **164** is 30% to 60%, preferably 35% to 45%. If the porosity is too high, the risk of leakage will be increased, if the porosity is too low, there will be insufficient liquid supply and other issues. The liquid absorption element **164** defines an internal atomizing passage **165** in an axial direction in communication with the channel **151**. The liquid absorption element **164** has a liquid absorption surface **1642** contacting the storage medium **153** and configured to absorb the liquid. In the illustrated embodiment, the liquid absorption surface **1642** is an outer circumferential surface of the liquid absorption element **164**. The liquid absorption element **164** further has an atomizing surface **1652** on the sidewall of the atomizing passage **165**.

The heating element **166** is embedded in an interior of the liquid absorption element **164**. In the illustrated embodiment, the heating element **166** is a spiral tubular heating wire, and an edge of the heating element **166** is internally tangent (aligned) to the atomizing surface **1652**. The heating element **166** is made of a conductive material, such as flexible metals or alloys, preferably nichrome wire. When the heating element **166** is powered, the liquid absorption element **164** can be heated by the heating element **166**, such that the liquid stored inside the liquid absorption element **164** will be uniformly heated and atomized into uniform vapor particles (i.e. smoke). The smoke enters the atomizing passage **165** through the atomizing surface **1652**, and then enters the channel **151**, and finally inhaled by the user via the air outlet **142**.

In the conventional electronic cigarette, since the inner surface of the spiral heating wire is not be in direct contact with the liquid, it can only absorb very few liquid by capillary action or surface tension, which will lead to some problems, such as: a), once the heating wire is powered, the inner side temperature will rise instantaneously, burst sound will be produced upon in contact with the liquid (because the temperature of the liquid is low, the inside temperature of the heating wire is too high); b), during the atomization process, the attached liquid is too little, which results in a great temperature difference between the inner side and the outer side of the spiral heating wire. Since the temperature of the inner side of the heating wire is high, once the liquid is in

contact with this hot area, the liquid may be cracked or chemical reaction may take place due to the high temperature, an formaldehyde gas may even be produced; c), when drawing by the user, the airflow temperature is higher due to the direct contact of the airflow with the inner side of the heating wire. Meanwhile, the heat on the inner side of the heating wire is wasted, thus resulting in a lower atomizing efficiency. However, in the illustrated embodiment, the heating element **166** is completely embedded inside the liquid absorption element **164**, and the liquid absorption element **164** composed by porous ceramic is full of liquid, such that the heating element **166** is in complete contact with the liquid, which brings the following advantages: a), the inner surface and the outer surface of the spiral heating wire have a uniform temperature distribution; b), there is less waste of the heat; c), there is no or very few liquid crackle sound; d), no or very few formaldehyde or other harmful substance will be produced.

Referring to FIG. **3**A, in one embodiment, the heating element **166** spirally surrounds the atomizing passage **165**, and a distance d between the heating element **166** to the atomizing surface **1652** is less than a distance D between the heating element **166** to the liquid absorption surface **1642** of the liquid absorption element **164**. Therefore, the liquid absorption surface **1642** of the liquid absorption element **164** composed of porous ceramic has a lower temperature and does not transfer too much heat to the liquid in the liquid reservoir **150**, thus avoiding the temperature rise of the liquid which is not atomized. Or else, the energy is wasted on the one hand, and it is on the other hand inconvenient for the user to hold. In an alternative embodiment, a thermal conductivity of the liquid absorption element is gradually reduced from inside to outside along a radial direction, which can also reduce the surface temperature of the electronic cigarette.

According to an embodiment, a method of manufacturing an atomizing assembly includes the following steps:

In step one, a positioning element is provided, the positioning element has a positioning post.

In step two, a heating element is wound spirally around the positioning post.

In step three, the positioning post wound with the heating element is placed into a mold, a first layer of ceramic material is injection molded on a surface of the heating element and then cured.

In step four, the positioning post is removed from the cured first layer of ceramic material.

In step five, the cured first layer of ceramic material is sintered, thus a liquid absorption element made of porous ceramic and a heating element embedded in an interior of the liquid absorption element are obtained.

According to the foregoing method, the heating wire is sintered and embedded into the liquid absorption element made of porous ceramic, which brings the following advantages: the heating wire can be supported by the liquid absorption element, such that the diameter thereof can be smaller. In the case of the same resistance value, the smaller the diameter, the shorter the length, therefore, the overall volume will be reduced. This on the one hand can save the materials, and more importantly, the components can be miniaturized. The volume of the liquid absorption element wrapping the heating wire can be reduced, thus the rate of temperature rise of the entire liquid absorption element can be increased.

Referring to FIG. **3**B, in an alternative embodiment, the liquid absorption element **164** includes a first layer **164***a* positioned proximately to the atomizing passage **165** and a second layer **164***b* positioned away from the atomizing passage **165**. The first layer **164***a* and the second layer **164***b* are made of different materials, and the first layer **164***a* has a higher thermal conductivity than a thermal conductivity of the second layer **164***b*. The heating element **166** is embedded in the first layer **164***a* of the liquid absorption element **164**. This configuration also allows for lowering the temperature of the liquid absorption surface of the liquid absorption element **164**, thus saving energy and improving the user experience.

According to an embodiment, a method of manufacturing an atomizing assembly includes the following steps:

In step one, a positioning element is provided, the positioning element has a positioning post.

In step two, a heating element is wound spirally around the positioning post.

In step three, the positioning post with the heating element is placed into a mold, a first layer of ceramic material is injection molded on a surface of the heating element and then cured.

In step four, a second layer of ceramic material is injected on the surface of the first layer of ceramic material and then cured. The first layer of ceramic material has a higher thermal conductivity than a thermal conductivity of the second layer of ceramic material.

In step five, the positioning post is removed from the cured first and second layers of ceramic material.

In step six, the cured first and second layers of ceramic material are sintered, thus a liquid absorption element made of porous ceramic and a heating element embedded in an interior of the liquid absorption element are obtained.

Referring to FIG. **1**, the power source **180** includes an electrode holder **184** and a battery (not shown). Both ends of the heating element **166** are coupled to the electrode holder **184** of the power source **180** via two wires **182**. The battery is used for providing power for the heating element **166**. It is to be understood that, the power source **180** may also include conventional elements such as a sensor, an indicator, etc., which are not elaborated herein.

Referring to FIG. **4** and FIG. **5**, an electronic cigarette **200** of a second embodiment has a similar structure as that of the electronic cigarette **100** of the first embodiment and includes a housing **220**, a mouthpiece **240**, a liquid reservoir **250**, an atomizing assembly **260**, and a power source assembly **280**. The differences lie in that: in the illustrated embodiment, the liquid absorption element **264** is shaped substantially as a circular tube that matches with housing **220**. The liquid absorption element **264** is received in the housing **220** and is located at an end of the liquid reservoir **250**. The liquid absorption element **264** has a liquid absorption surface **2642** facing the liquid reservoir **250** and configured to absorb the liquid. The liquid from the liquid reservoir **250** can be uniformly dispersed in the interior and surface of the liquid absorption element **264** via the liquid absorption surface **2642** by capillary action. The liquid absorption element **264** defines an internal atomizing passage **265** in an axial direction in communication with the channel **251**. The heating element **266** is a spiral tubular heating wire, which is embedded in an interior of the liquid absorption element **264**. The heating element **266** spirally surrounds the atomizing passage **265**, and an edge of the heating element **266** is internally tangent (aligned) to the atomizing surface **2652**. Compared with the first embodiment, the liquid absorption element **264** of the second embodiment is located at the end of the liquid reservoir **250**, thus it can facilitate the installation.

Referring to FIG. **6** and FIG. **7**, an electronic cigarette **300** of a third embodiment has a similar structure as that of the electronic cigarette **200** of the second embodiment and includes a housing **320**, a mouthpiece **340**, a liquid reservoir **350**, an atomizing assembly **360**, and a power source assembly **380**. The differences lie in that: the electronic cigarette **300** further includes a reservoir cover **37** positioned between the liquid reservoir **350** and the liquid absorption element **364**. The reservoir cover **37** is shaped substantially as a round cover and is located at an end of the liquid reservoir **350** to seal the liquid reservoir **350**. The reservoir cover **37** defines an airflow channel **372** in a middle portion thereof in communication with the channel **351**. The reservoir cover **37** further defines four liquid conduction channels **374** evenly distributed around the airflow channel **372**. No liquid medium is provided in the reservoir **350**, and the liquid in the liquid reservoir **350** can flow into the liquid absorption element **364** via the four liquid conduction channels **374**. The liquid absorption element **364** defines an internal atomizing passage **365** in an axial direction in communication with the airflow channel **372**. The heating element **366** is a spiral tubular heating wire, which is embedded in an interior of the liquid absorption element **364**. Compared with the second embodiment, the liquid of the third embodiment can flow into the liquid absorption element **364** via the liquid conduction channels **374**, such that the flow of liquid can be more accurately controlled. It should be noted that, the number of the liquid conduction channels **374** can be three, five or more.

Referring to FIG. **8** and FIG. **9**, an electronic cigarette **400** a fourth embodiment is similar to the electronic cigarette **200** of the second embodiment. The electronic cigarette **400** includes a housing **420**, a mouthpiece **440**, a liquid reservoir **450**, an atomizing assembly **460**, and a power source assembly **480**. The difference lies in that: the atomizing surface **4642** is an end surface of the liquid absorption element **464** away from the liquid reservoir **450**. The heating element **466** is a planar spiral heating wire having Archimedes spiral. The heating element **466** is embedded in an interior of the liquid absorption element **464** and is located at an end of the liquid absorption element **464** away from the liquid reservoir **450**. The heating element **466** spirally surrounds the atomizing passage **465**, and an edge of the heating element **466** is internally tangent (aligned) to the atomizing surface **4642**. When the heating element **466** is powered, the liquid absorption element **464** can be heated by the heating element **466** from one end thereof, such that the liquid stored inside the liquid absorption element **464** will be uniformly heated and atomized into uniform vapor particles (i.e. smoke). The smoke enters the atomizing passage **465** through the atomizing surface **4642**, and then enters the channel **451**, and finally inhaled by the user via the air outlet.

In one embodiment, a method of manufacturing the aforementioned atomizing assembly includes the following steps:

In step one, a positioning element is provided. The positioning element includes a positioning surface and a positioning post located on the positioning surface.

In step two, a heating element being a planar helical heating wire is placed on the positioning surface and surrounds the positioning post;

In step three, the positioning post with the heating element is placed into a mold, a first layer of ceramic material is injection molded on a surface of the heating element and then cured;

In step four, the positioning post is removed from the cured first layer of ceramic material;

In step five, the cured first layer of ceramic material is sintered, thus obtaining a liquid absorption element made of porous ceramic and a heating element embedded at an end of the liquid absorption element.

Referring to FIG. **10**, an electronic cigarette **500** in accordance with a fifth embodiment includes a housing **510**, a liquid reservoir **520**, an atomizing assembly **530**, and a power source assembly **540**. The liquid reservoir **520**, the atomizing assembly **530**, and the power source assembly **540** are received in the housing **510**. The power source assembly **540** is configured to provide power for the atomizing assembly **530**.

The housing **510** has a substantially cylindrical shape, that is, a circular cross section. The housing **510** defines a cavity for accommodating each internal element of the electronic cigarette **500**. The housing **510** is made of plastic. In alternative embodiments, the housing **510** can have a rectangular or oval cross-section. One end of the housing **510** defines an air outlet **512** at an end thereof and an air inlet (not shown) at the other end thereof. The housing **510** has a hollow structure. The housing **510** can be provided with a filter nozzle at the end thereof adjacent to the air outlet **512** for filtering nicotine and nicotinamide in the smoke.

The liquid reservoir **520** is received in the housing **510** and sleeved on the outside of the atomizing assembly **530**. In the illustrated embodiment, the liquid reservoir **520** has a cylindrical shape and defines a channel **521** along an axial direction in a middle portion thereof, which is in communication with the air inlet and the air outlet **512**. The liquid reservoir **520** is internally filled with a liquid storage medium **522** for storing liquid. The liquid storage medium **522** can be made of liquid absorbent materials, such as fiber, foam, sponge, foam ceramic, soft rubber or silicon. The material forming the liquid reservoir **520** may have elasticity, such that during assembly, the liquid reservoir **520** may be in sufficient contact with the surface of the atomizing assembly **530** by an external force such as pressing. According to the principle of concentration balance, the liquid stored in the liquid reservoir **520** can be delivered to the atomizing assembly **530** with liquid absorbing capability.

The atomizing assembly **530** is received in the housing **510**. The atomizing assembly **530** includes a support element **532**, a liquid absorption element **533**, and a heating element **534**. The liquid absorption element **533** is disposed on the support element **532** and extends through the support element **532**.

The support element **532** has a hollow cylindrical structure and is received in the channel **521**. The support element **532** defines an atomizing passage **536** therein in communication with the channel **521** to allow the gas to flow through. The support element **532** further defines two aligned through holes **538** on a middle portion of the sidewall thereof, the two through holes **538** are used to support and fix the liquid absorption element **533**. The through holes **538** are in communication with the atomizing passage **536**. It should be understood that, the number of the through holes **538** can be one or more than two.

Referring to FIG. **11**, the liquid absorption element **533** is shaped substantially as a solid cylinder that matches with the through holes **538**. Accordingly, both ends of the liquid absorption element **533** can extend through the through holes **538** of the support element **532**, respectively, therefore the liquid absorption element **533** can extend inside the liquid reservoir **520** to be in direct contact with the liquid storage medium **522**. A middle portion of the liquid absorption element **533** is positioned inside the atomizing passage **536**, and the liquid absorption element **533** has an atomizing

surface **5332** within the atomizing passage **536**. The liquid absorption element **533** can be made of a porous ceramic material with liquid storage capability and high temperature resistance. In the illustrated embodiment, the liquid absorption surface of the liquid absorption element **533** are at both ends of the liquid absorption element **533**, which include both end surfaces and partial outer circumferential surface.

The heating element **534** is a spiral tubular heating wire embedded in an interior of the liquid absorption element **533**, and the heating wire helically surrounds an axis of the liquid absorption element **533**. In the illustrated embodiment, an edge of the heating element **534** is internally tangent (aligned) to the atomizing surface **5332**. The heating element **534** is made of a conductive material, such as flexible metals or alloys, preferably nichrome wire. When the heating element **534** is powered, the liquid absorption element **533** can be heated by the heating element **534**, such that the liquid stored inside the liquid absorption element **533** will be uniformly heated and atomized into uniform vapor particles (i.e. smoke). The smoke enters the atomizing passage **536** through the atomizing surface **5332**, and then enters the channel **521**, and finally inhaled by the user via the air outlet **512**.

Referring to FIG. **10**, the power source assembly **540** is electrically coupled to the heating element **534**, so as to provide power for the heating element **534**. In the illustrated embodiment, the power supply assembly **540** includes an electrode **542**, a conductive wire **544**, an electrode holder **546**, and a battery (not shown). The electrode **542** is electrically coupled to the heating element **534** through the conductive wire **544**. The electrode **542** is fixed on the electrode holder **546**. The electrode holder **546** defines an air intake **548** to allow the air to pass through. In an alternative embodiment, the electrode holder **546** can be omitted.

Referring to FIG. **12** and FIG. **13**, an electronic cigarette **600** according to a sixth embodiment has a similar structure as that of the electronic cigarette **500** of the fifth embodiment and includes a housing **610**, a liquid reservoir **620**, an atomizing assembly **630**, and a power source assembly **640**. The difference lies in that:

(1) No storage medium is filled in the liquid reservoir **620**, and the liquid is directly stored in the liquid reservoir **620**.

(2) The liquid absorption element **633** is located at a position of the support element **632** adjacent to the power source assembly **640**.

(3) The liquid absorption element **633** has a tubular tube shape and axially defines a liquid passage **635** therein. The atomizing surface is an outer circumferential surface of the liquid absorption element **633**, and the liquid absorption surface is an inner circumferential surface of the liquid absorption element **633**, i.e., the liquid absorption surface is a sidewall of the liquid passage **635**.

The liquid absorption element **533** of the fifth embodiment absorbs and stores liquid in the liquid storage medium **522** mainly through two ends thereof, thus the liquid conduction rate may be relatively slow. The liquid reservoir **620** of the sixth embodiment directly contains the liquid, and the atomizing assembly **630** is positioned downwardly, and the liquid passage **634** is axially defined in the liquid absorption element **633**, such that the contact area with the liquid is increased, thus increasing the liquid conduction rate.

Although the respective embodiments have been described one by one, it shall be appreciated that the respective embodiments will not be isolated. Those skilled in the art can apparently appreciate upon reading the disclosure of this application that the respective technical features involved in the respective embodiments can be combined arbitrarily between the respective embodiments as long as they have no collision with each other. Of course, the respective technical features mentioned in the same embodiment can also be combined arbitrarily as long as they have no collision with each other.

It should be noted that, the configuration how the liquid absorption surface for absorbing liquid and the atomizing surface for the heating element are positioned on the liquid absorption element are not limited hereto. The number of the liquid absorption surfaces may be one or more, and the number of the atomizing surfaces may also be one or more.

Although the description is illustrated and described herein with reference to certain embodiments, the description is not intended to be limited to the details shown. Modifications may be made in the details within the scope and range equivalents of the claims.

What is claimed is:

1. An electronic cigarette, comprising:

a liquid reservoir configured to store liquid;

an atomizing assembly comprising:

a liquid absorption element connected to the liquid reservoir, the liquid absorption element being made of porous ceramic, and the liquid absorption element having a liquid absorption surface configured to absorb the liquid, and an atomizing surface;

a heating element embedded in an interior of the liquid absorption element, wherein an edge of the heating element is internally tangent to the atomizing surface, and the heating element is configured to atomize the liquid absorbed by the liquid absorption element into atomized gas; and

a power source assembly connected to the atomizing assembly, the power source assembly being configured to provide power for the heating element.

2. The electronic cigarette according to claim **1**, wherein the liquid absorption element has a tubular shape, the liquid absorption element defines an atomizing passage therein, the atomizing surface is a sidewall of the atomizing passage, and the heating element is a spiral tubular heating wire, which spirally surrounds the atomizing passage.

3. The electronic cigarette according to claim **2**, wherein a distance between the heating wire to the atomizing surface is less than a distance between the heating wire to the liquid absorption surface of the liquid absorption element.

4. The electronic cigarette according to claim **2**, wherein a thermal conductivity of the liquid absorption element is gradually reduced from inside to outside along a radial direction.

5. The electronic cigarette according to claim **2**, wherein the liquid absorption element comprises a first layer proximately to the atomizing passage and a second layer away from the atomizing passage, the first layer has a higher thermal conductivity than a thermal conductivity of the second layer, the heating element is embedded in the first layer of the liquid absorption element.

6. The electronic cigarette according to claim **1**, wherein the porous ceramic has a porosity of 30% to 60%.

7. The electronic cigarette according to claim **2**, wherein the liquid absorption surface is an outer circumferential surface of the liquid absorption element.

8. The electronic cigarette according to claim **1**, wherein the liquid absorption element is located at an end of the liquid reservoir, the liquid absorption surface is a surface of the liquid absorption element facing the liquid reservoir.

9. The electronic cigarette according to claim **1**, wherein the liquid absorption element has a tubular shape, the atomizing surface is an outer circumferential surface of the

liquid absorption element, and the liquid absorption surface is an inner circumferential surface of the liquid absorption element.

10. The electronic cigarette according to claim **1**, wherein the liquid absorption element is located at an end of the liquid reservoir, the atomizing surface is an end surface of the liquid absorption element away from the liquid reservoir, and the heating element is a planar helical heating wire.

11. An electronic cigarette, comprising:

a liquid reservoir configured to store liquid;

an atomizing assembly comprising:

a support element defining an atomizing passage therein, the support element defining two aligned through holes on a sidewall thereof in communication with the atomizing passage;

a liquid absorption element made of porous ceramic, wherein both ends of the liquid absorption element extend through the through holes and extend inside the liquid reservoir, the liquid absorption element having a liquid absorption surface configured to absorb the liquid and an atomizing surface located inside the atomizing passage;

a heating element embedded in an interior of the liquid absorption element, wherein an edge of the heating element is internally tangent to the atomizing surface; and

a power source assembly connected to the atomizing assembly, the power source assembly being configured to provide power for the heating element.

12. The electronic cigarette according to claim **11**, wherein the heating element is a spiral tubular heating wire, which spirally surrounds an axis of the liquid absorption element.

13. The electronic cigarette according to claim **11**, wherein the liquid absorption element defines a liquid channel therein along an axial direction.

14. The electronic cigarette according to claim **13**, wherein the liquid absorption element is positioned on the support element proximately to the power source assembly.

* * * * *

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Chen

(10) **Patent No.: US 10,791,763 B2**
(45) **Date of Patent: Oct. 6, 2020**

(54) **ATOMIZER CAPABLE OF PREVENTING LIQUID LEAKAGE CAUSED BY AIR INSIDE A LIQUID RESERVOIR AND ELECTRONIC CIGARETTE WITH THE SAME**

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(72) Inventor: **Zhiping Chen**, Shenzhen (CN)

(73) Assignee: **SHENZHEN SMOORE TECHNOLOGY LIMITED**, Shenzhen (CN)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 341 days.

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**

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A24F 17/00	(2006.01)
A24F 25/00	(2006.01)
A24F 47/00	(2020.01)
H05B 3/06	(2006.01)
H05B 3/03	(2006.01)
H05B 1/02	(2006.01)

(52) **U.S. Cl.**

CPC ***A24F 47/008*** (2013.01); ***H05B 1/0227*** (2013.01); ***H05B 3/03*** (2013.01); ***H05B 3/06*** (2013.01)

(58) **Field of Classification Search**

CPC A24F 47/008; A24F 47/002; A24F 40/00; A24F 40/42; A24F 40/485; H05B 3/06; H05B 3/03

USPC 131/329, 328

See application file for complete search history.

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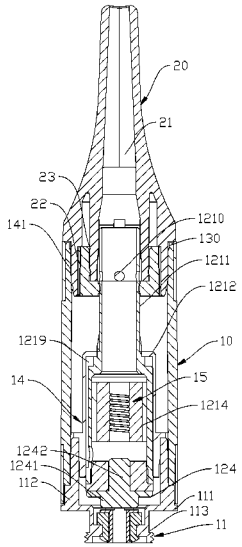
Primary Examiner — Hae Moon Hyeon

(74) *Attorney, Agent, or Firm* — Hemisphere Law, PLLC; Zhigang Ma

(57) **ABSTRACT**

The present disclosure provides an atomizer and an electronic cigarette with the atomizer. The atomizer includes a cartridge assembly and a mouthpiece assembly; the cartridge assembly includes a liquid reservoir, an opening communicating the liquid reservoir with an external environment, and an atomization chamber communicating with the liquid reservoir; the mouthpiece assembly is inserted into the opening; the cartridge assembly includes an engaging portion located adjacent to the opening, and the mouthpiece assembly includes an inserting portion inserted into the engaging portion; the inserting portion defines a discharging hole, air discharges through the discharging hole while the inserting portion is being inserted into the engaging portion, and after the inserting portion is inserted into the engaging portion in place, the discharging hole is blocked, thus, e-liquid in the liquid reservoir can be prevented from being pushed to flow into the atomization chamber and liquid leakage can be prevented.

20 Claims, 10 Drawing Sheets



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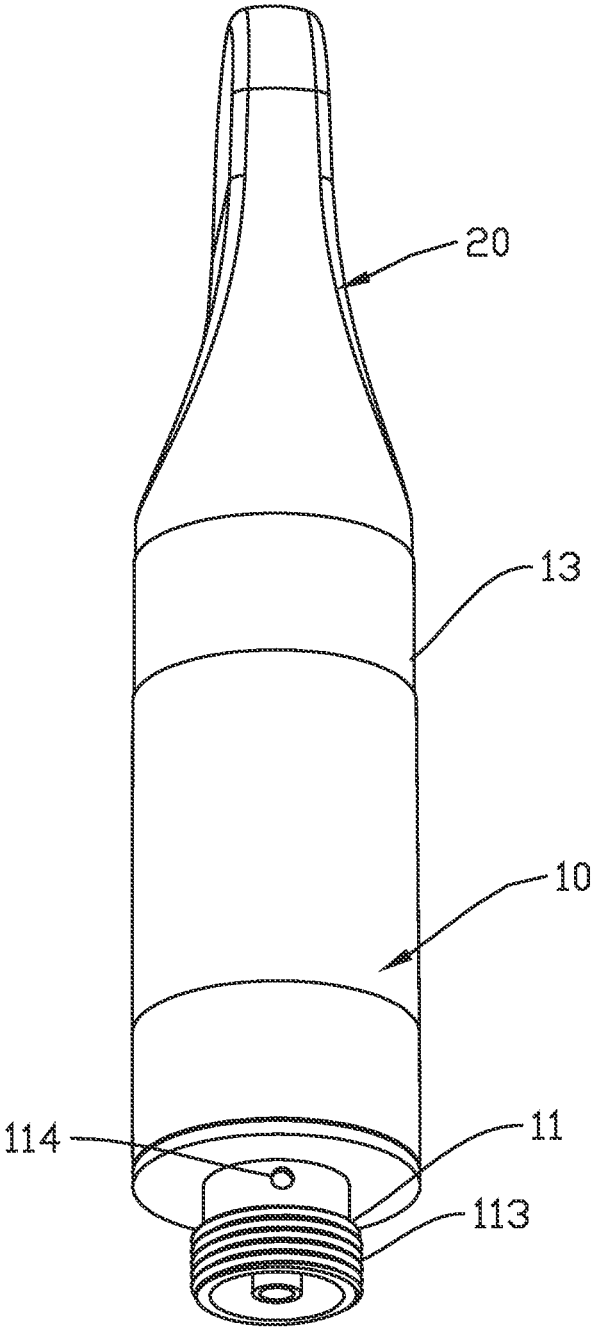

FIG. 1

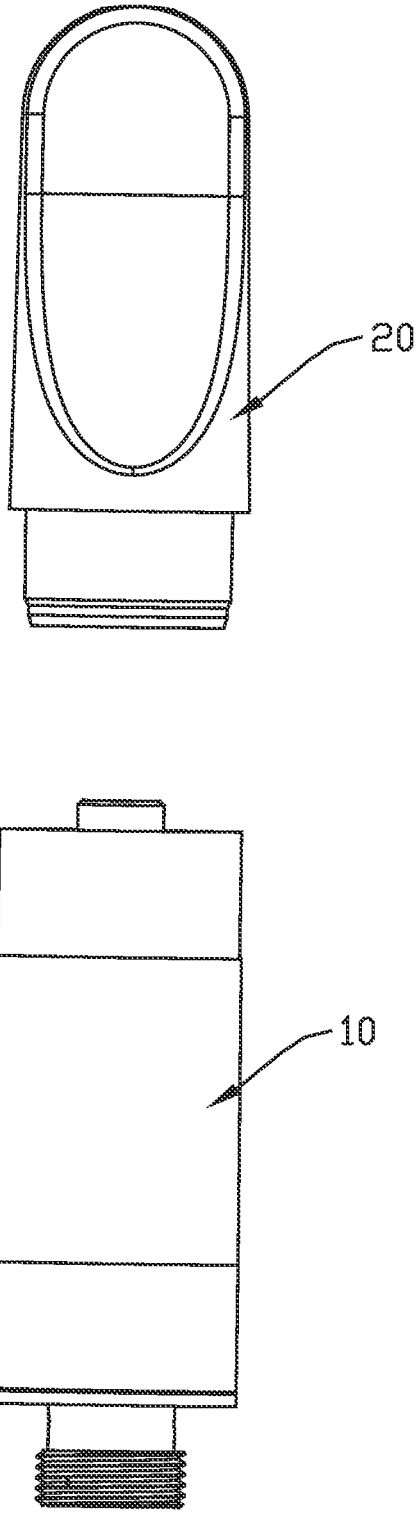

FIG. 2

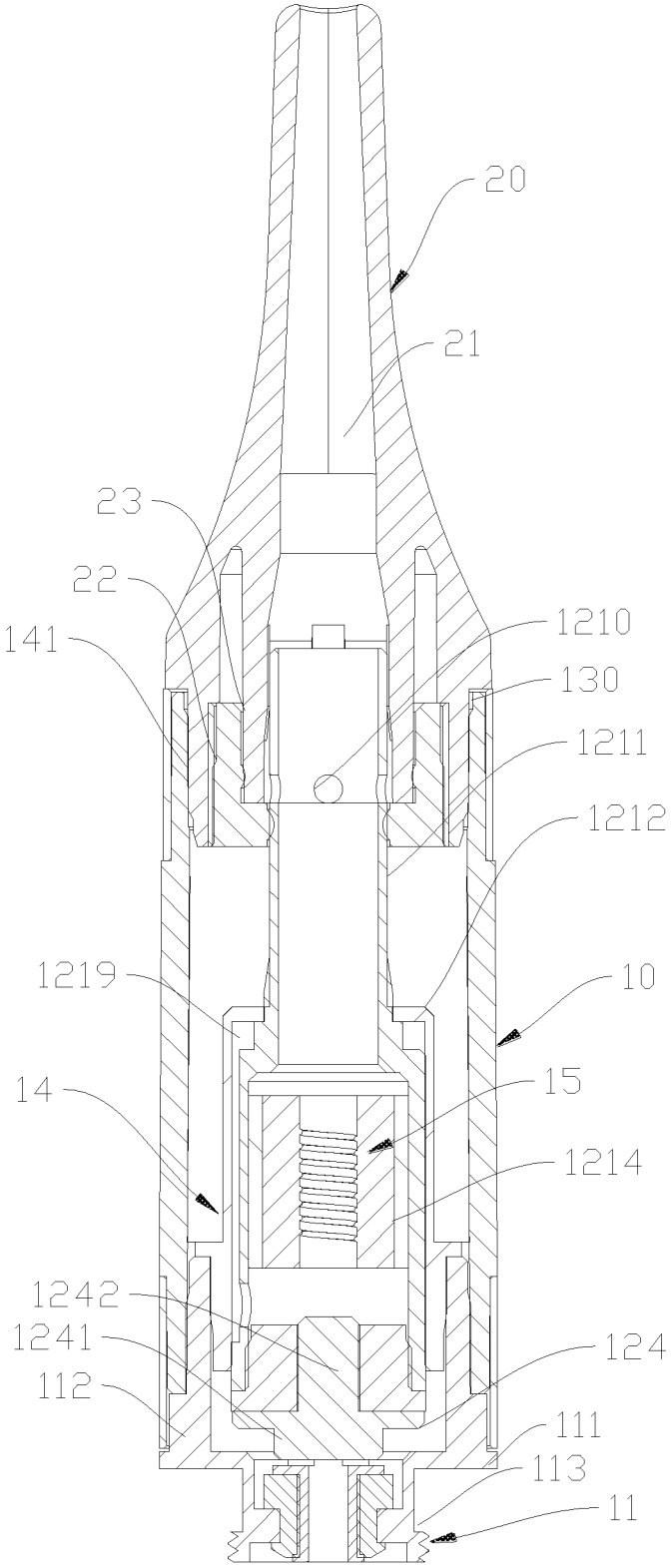
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FIG. 3

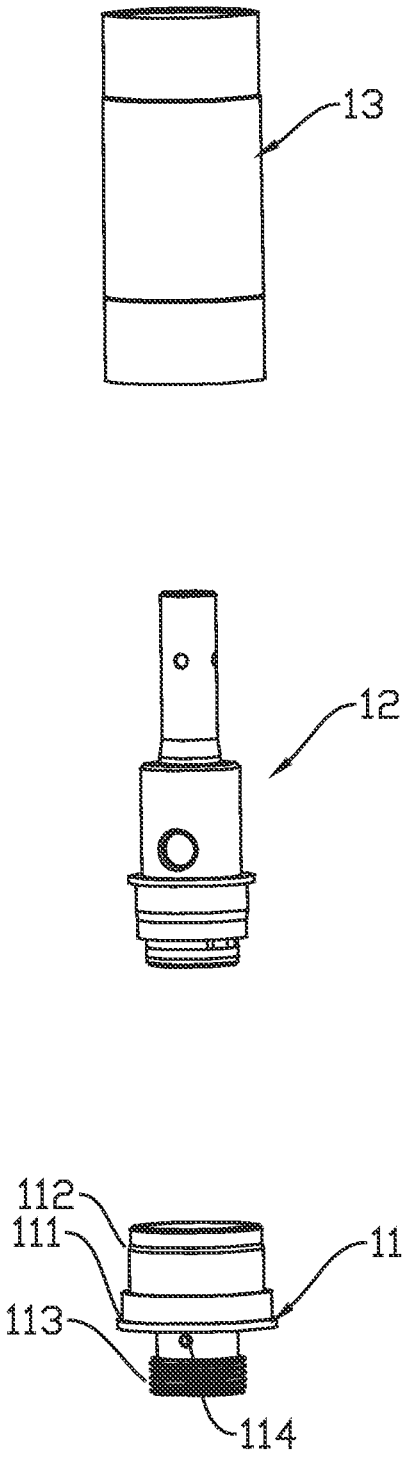

FIG. 4

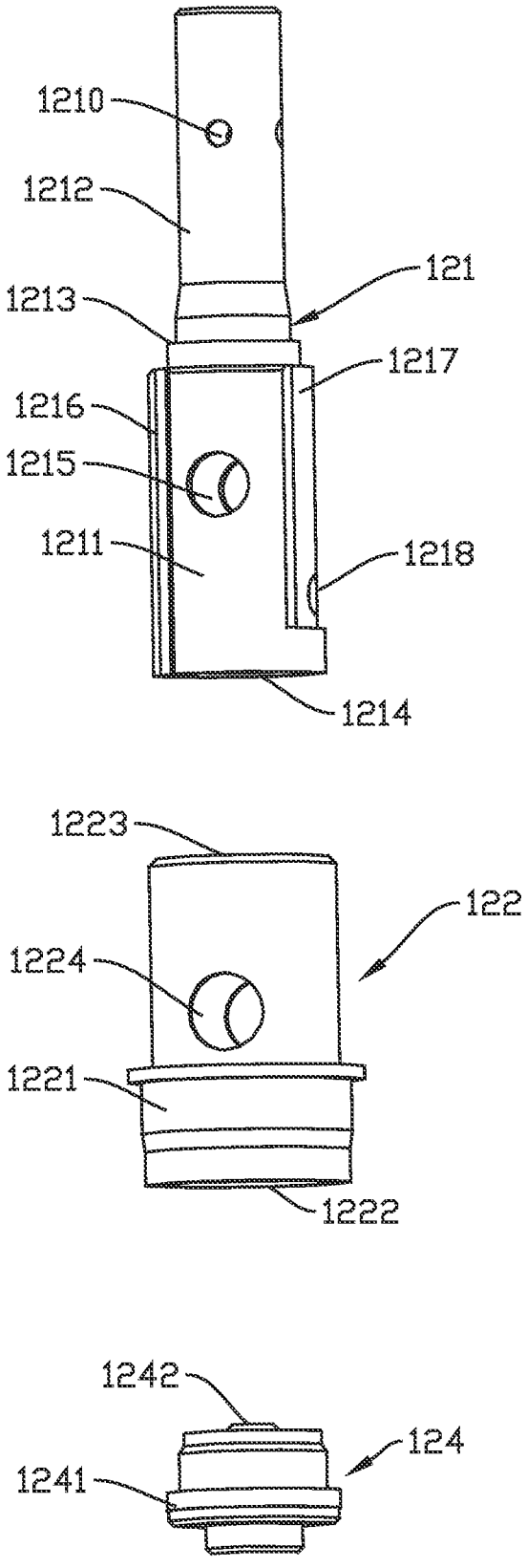
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FIG. 5

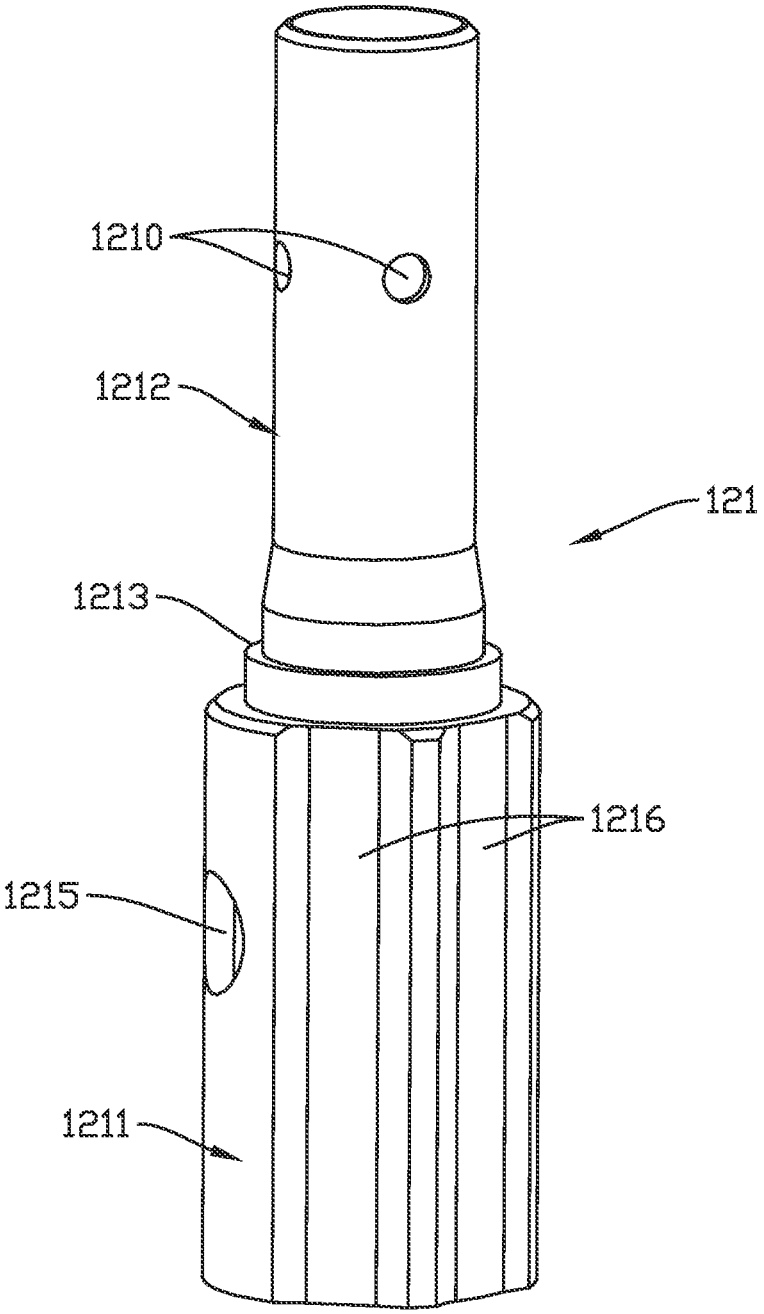

FIG. 6

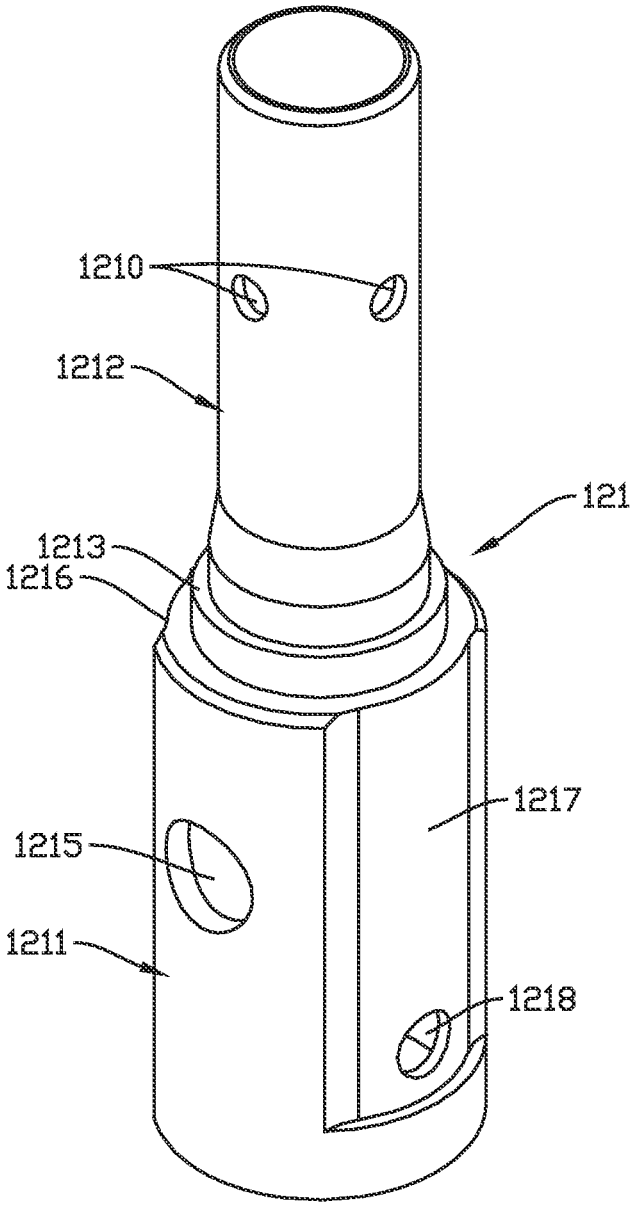

FIG. 7

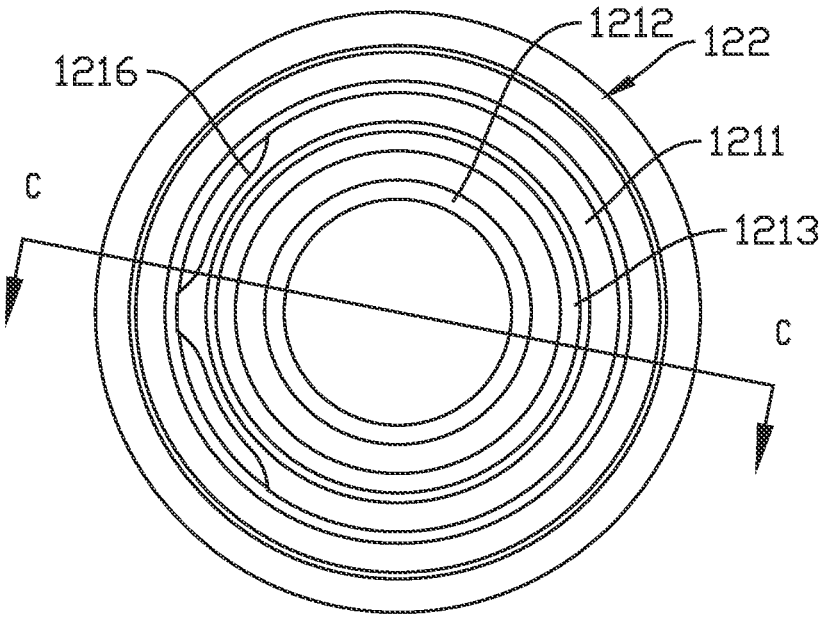

FIG. 8

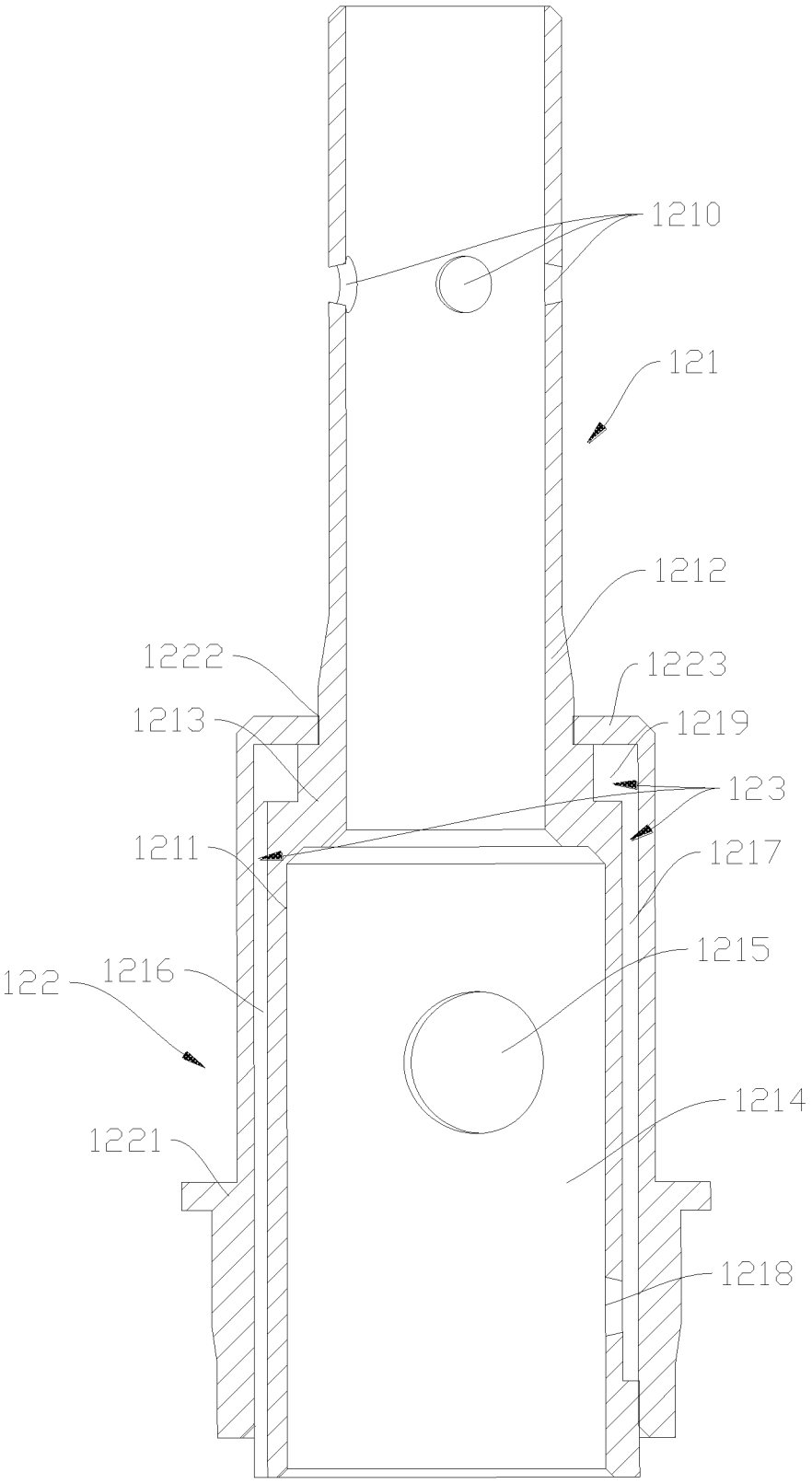
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FIG. 9

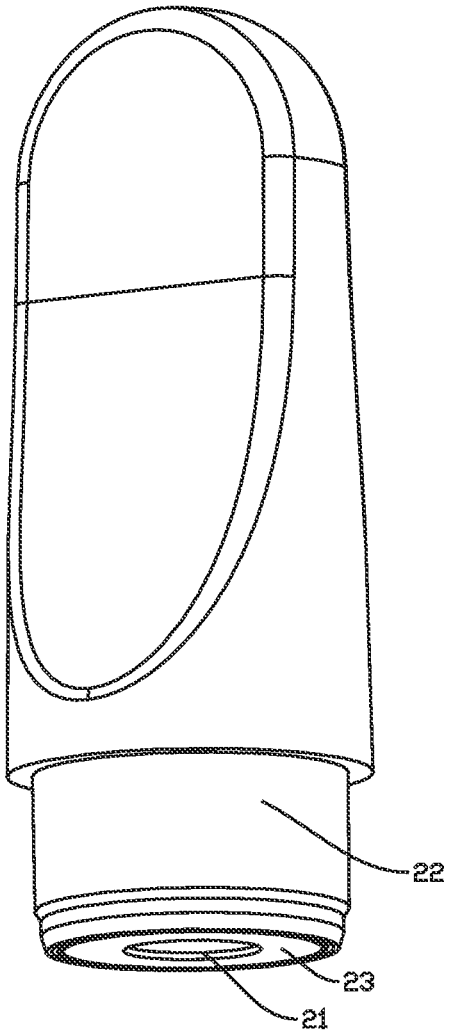

FIG. 10

ATOMIZER CAPABLE OF PREVENTING LIQUID LEAKAGE CAUSED BY AIR INSIDE A LIQUID RESERVOIR AND ELECTRONIC CIGARETTE WITH THE SAME

TECHNICAL FIELD

The present disclosure relates to substitutes for cigarettes, and more particularly, to an atomizer and an electronic cigarette with the same.

BACKGROUND

At present, electronic cigarettes have become mature substitutes for tobacco cigarettes. The electronic cigarette atomizes e-liquid in an atomizer by heating a heating element through a power supply, thereby providing harmless smoke. As a key component of the electronic cigarette, the atomizer plays an important role in the performance of the electronic cigarette.

At present, in some disposable electronic cigarettes, e-liquid is injected in to the electronic cigarette from a top of the atomizer after the assembly of an atomization core is finished, and then a mouthpiece assembly is mounted to the atomizer to seal a top of a liquid reservoir of the atomizer. However, during this process, a part of the mouthpiece assembly needs to extend into the liquid reservoir, that is, a part of the mouthpiece assembly may be moved into the liquid reservoir; since the mouthpiece assembly and the atomizer are air-tight, the movement of the mouthpiece assembly may compress the air inside the liquid reservoir and further push the e-liquid in the liquid reservoir to flow into the atomization core, thereby causing the leakage of the e-liquid.

SUMMARY OF THE DISCLOSURE

The present disclosure provides an atomizer which is capable of preventing liquid leakage caused by that air inside a liquid reservoir is compressed by a mouthpiece assembly to drive e-liquid inside the liquid reservoir to flow into an atomization core during the assembly of the mouthpiece assembly. The present disclosure further provides an electronic cigarette with the atomizer.

The atomizer applicable in an electronic cigarette includes a cartridge assembly, a mouthpiece assembly; the cartridge assembly includes a liquid reservoir, an opening communicating the liquid reservoir with an external environment, and an atomization chamber communicating with the liquid reservoir; the mouthpiece assembly is inserted into the opening; the cartridge assembly includes an engaging portion located adjacent to the opening, the mouthpiece assembly includes an inserting portion inserted into the engaging portion; the engaging portion defines a discharging hole for discharging air inside the liquid reservoir while the inserting portion is being inserted into the engaging portion, and after the inserting portion is inserted into the engaging portion in place, the discharging hole is blocked by the inserting portion.

In an embodiment, the inserting portion is detachably inserted into the engaging portion.

In an embodiment, the cartridge assembly includes a base, an air flowing tube assembly mounted on the base, a cartridge sleeved on the air flowing tube assembly; and the liquid reservoir is formed between an outer wall of the air flowing tube assembly and an inner wall of the cartridge;

the air flowing tube assembly includes an inner air flowing tube, and the discharging hole is defined in a top of a wall of the inner air flowing tube; and the inner air flowing tube forms the atomization chamber;

the mouthpiece assembly further includes a sealing member and an air outlet tube communicating with the inner air flowing tube; and

the sealing member is inserted into the inserting portion for blocking the discharging hole.

In an embodiment, the inner air flowing tube includes a first tube section, a second tube section communicating with the mouthpiece assembly, and a step formed at the connection between the first tube section and the second tube section; and a diameter of the second tube section is less than that of the first tube section;

the discharging hole is defined in the second tube section and communicates with the second tube section; and

the second tube section is inserted into the inserting portion, and the sealing member is sleeved on the second tube section and corresponds to the discharging hole.

In an embodiment, the air flowing tube assembly includes an outer air flowing tube sleeved on the inner air flowing tube;

the outer air flowing tube includes a tube body and a cover located on one end of the tube body, and a through hole is defined in the cover;

the tube body is sleeved on the first tube section, an inner surface of the tube body tightly contacts an outer surface of the first tube section, and the second tube section passes through the through hole; a bottom diameter of the tube body matches with that of the first tube section, and a top diameter of the tube body matches with that of the second tube section; and

the liquid reservoir is formed between an outer surface of the tube body and an inner surface of the cartridge, and an airflow channel is formed between the inner surface of the tube body and the outer surface of the first tube section.

In an embodiment, the first tube section forms the atomization chamber, and an atomization assembly is arranged in the atomization assembly; and

at least one liquid absorbing hole is defined in the first tube section and the outer air flowing tube, and the liquid absorbing hole defined in the outer air flowing tube corresponds to and communicate with the liquid absorbing hole defined in the first tube section.

In an embodiment, the base includes a plate, a mounting portion arranged on the plate and extending towards a top of the atomizer, and a connecting portion located on a bottom of the plate; and

a first air inlet is formed in the connecting portion; the air flowing tube assembly and the cartridge are located on the mounting portion, and the cartridge is sleeved on the mounting portion;

In an embodiment, a first air intake slot and a second air intake slot are formed on the outer surface of the first tube section, the first air intake slot communicates with the first air inlet, and the second air intake slot faces away from the first air intake slot; a second air inlet communicating with the inner air flowing tube is formed in the second air intake slot; the step supports the cover, and a gap between the firs tube section and a top of the cover forms a communication channel communicating the first air intake slot with the second air intake slot; and

the airflow channel comprises the first air intake slot, the second air intake slot, and the communication channel.

In an embodiment, a blocking assembly is arranged on one end of the first tube section adjacent to the base for blocking the inner air flowing tube.

In an embodiment, the blocking assembly includes a sealing cover and an electrode located at the center of the sealing cover; and

the electrode abuts a positive pole of the base, a positive pole of the atomization assembly is connected to the electrode, and a negative pole of the atomization assembly is connected to a negative pole of the base through the outer air flowing tube and the inner air flowing tube.

The present disclosure further provides an electronic cigarette, including the above atomizer.

Since the engaging portion is located adjacent to the opening of the liquid reservoir of the cartridge which communicates with the external environment and the engaging portion defines the discharging hole, air inside the liquid reservoir can discharge out of the liquid reservoir from the discharging hole when the inserting portion of the mouthpiece assembly is being inserted into the engaging portion, thus, liquid leakage caused by that air inside the liquid reservoir drives the e-liquid to flow into the atomization chamber can be prevented; in addition, after the inserting portion is totally inserted into the engaging portion, the inserting portion blocks the discharging hole, preventing liquid leakage from the discharging hole.

BRIEF DESCRIPTION OF THE DRAWINGS

The present disclosure will be described in more detail with reference to the accompany drawings and the embodiments, wherein in the drawings:

FIG. **1** is a perspective view of an atomizer applicable in an electronic cigarette in accordance with an embodiment of the present disclosure;

FIG. **2** is a partially exploded view of the atomizer of FIG. **1** in accordance with an embodiment of the present disclosure;

FIG. **3** is a cross-sectional view of the atomizer of FIG. **1** in accordance with an embodiment of the present disclosure;

FIG. **4** is an exploded view of a cartridge assembly of the atomizer of FIG. **1** in accordance with an embodiment of the present disclosure;

FIG. **5** is an exploded view of an air flowing tube assembly of the atomizer of FIG. **1** in accordance with an embodiment of the present disclosure;

FIG. **6** is a left side view of an inner air flowing tube of the atomizer of FIG. **5** in accordance with an embodiment of the present disclosure;

FIG. **7** is a right side view of the inner air flowing tube of atomizer of FIG. **5** in accordance with an embodiment of the present disclosure;

FIG. **8** is a top view of bottoms of the inner air flowing tube and an outer air flowing tube of the atomizer of FIG. **5** in accordance with an embodiment of the present disclosure;

FIG. **9** is a cross-sectional view of the inner air flowing tube and the outer air flowing tube of FIG. **8** taken along the line C-C in accordance with an embodiment of the present disclosure; and

FIG. **10** is a schematic view of a mouthpiece assembly of the atomizer of FIG. **1** in accordance with an embodiment of the present disclosure.

PREFERRED EMBODIMENTS

Referring to FIGS. **1** to **3**, an atomizer applicable in an electronic cigarette in accordance with an embodiment is provided. The atomizer is engageable with a power supply to form an electronic cigarette. The atomizer includes a cartridge assembly **10** and a mouthpiece assembly **20**. A top of the cartridge assembly **10** forms an opening and the mouthpiece assembly **20** is mounted in the opening of the cartridge assembly **10**. The cartridge assembly **10** is used for connecting to the power supply, storing e-liquid, and atomizing the e-liquid. The mouthpiece assembly **20** is used for covering the opening in the cartridge assembly **10** and guiding atomized smoke out.

As shown in FIGS. **3** and **4**, the cartridge assembly **10** includes a base **11**, an air flowing tube assembly **12** mounted on the base **11**, a cartridge **13**, and an atomization assembly **15** arranged in the air flowing tube assembly **12**. The base **11** is connected to the power supply. The air flowing tube assembly **12** is configured for discharging atomized smoke. The cartridge **13** surrounds the air flowing tube assembly **12**, and a liquid reservoir **14** is formed between an inner wall of the cartridge **13** and an outer wall of the air flowing tube assembly **12** for storing e-liquid of the electronic cigarette. The atomization assembly **15** is located in the cartridge **13** for atomizing the e-liquid.

In some embodiments, the air flowing tube assembly **12** and the cartridge **13** are cylindrical, and an outer diameter of the air flowing tube assembly **12** is less than an inner diameter of the cartridge **13**. In some embodiments, the air flowing tube assembly **12** is coaxial with the cartridge **13**.

The base **11** includes a plate **111**, a mounting portion **112** arranged on the plate **111** and extending upwards from the plate **111**, and a connecting portion **113** arranged on a bottom of the plate **111**. The mounting portion **112** is cylindrical. One side wall of the connecting portion **113** forms a first air inlet **114** for drawing air into the atomizer such that the atomizer can communicate with the external environment. The connecting portion **113** is provided with an electrode. The connecting portion **113** is cylindrical and an outer side of the connecting portion **113** is configured with threads; it is understood that the connecting portion **113** can be threaded to the power supply.

As shown in FIGS. **3** and **5**, in an embodiment, the air flowing tube assembly **12** is mounted in the mounting portion **112** of the base **11**, including an inner air flowing tube **121**, an outer air flowing tube **122** sleeved on the inner air flowing tube **121**, and a blocking assembly **124** for blocking the inner air flowing tube **121**. The inner air flowing tube **121** is configured for forming an atomization chamber **1214** for receiving the atomization assembly **15** and a channel for guiding smoke out. The outer air flowing tube **122** is configured for cooperating with the inner air flowing tube **121** to form an airflow channel **123** which extends towards a top of the atomizer for a certain distance from a bottom of the atomizer and then extends downwards from the top of the atomizer for a certain distance. The inner air flowing tube **121** and the outer air flowing tube **122** can be made of plastic, rubber, or alloy, etc.

In an embodiment, the inner air flowing tube **121** includes a first tube section **1211** and a second tube section **1212**. A diameter of the first tube section **1211** is greater than that of the second tube section **1212**. A step is formed at the connection between the first tube section **1211** and the second tube section **1212** for improving a tightness between the outer air flowing tube **122** and the inner air flowing tube **121**. The atomization chamber **1214** receiving the atomization assembly **15** is formed in the first tube section **1211**. The second tube section **1212** is configured for communicating with the mouthpiece assembly **20** to discharge the atomized smoke.

The first tube section **1211** includes two first liquid absorbing holes **1215** defined in two sides of the first tube section **1211**, a first air intake slot **1216** formed in a surface of the first tube section **1211**, a second air intake slot **1217** formed in the surface of the first tube section **1211** and facing away from the first air intake slot **1216**, and a second air inlet **1218** formed in the second air intake slot **1217**. The first liquid absorbing hole **1215** communicates with the liquid reservoir **14** for absorbing e-liquid entering into the atomization chamber **1214**. The first air intake slot **1216** extends towards a top of the first tube section **1212** from a bottom of the first tube section **1211** and communicates with the first air inlet **114**. The second air intake slot **1217** extends towards the second air inlet **1218** from the top of the first tube section **1211** for guiding air into the second air inlet **1218** such that air can be guided into the atomization chamber **1214**.

As shown in FIGS. **5** and **9**, the outer air flowing tube **122** includes a tube body **1221**, a cover **1223** located on one end of the tube body **1221**, a through hole **1222** defined in the cover **1223**, two second liquid absorbing holes **1224** defined in two sides of the tube body **1221**. The outer air flowing tube **122** is sleeved on the first tube section **1221**, and a length of the outer air flowing tube **122** is greater than that of the first tube section **1211**. A bottom diameter of the tube body **1221** matches with that of the first tube section **1211**, and a top diameter of the tube body **1221** matches with that of the second tube section **1212**. A communication channel **1219** is formed between a top of the tube body **1221** and the top of the first tube section **1211** for guiding air into the second air intake slot **1217** from the first air intake slot **1216**. The cover **1223** covers the communication channel **1219** to prevent air discharge from a top of the second tube section **1212**. The second liquid absorbing holes **1224** correspond to the first liquid absorbing holes **1215** defined in the first tube section **1211** and communicate with the first liquid absorbing holes **1215** respectively.

Referring to FIGS. **5** to **9**, the airflow channel **123** between the inner air flowing tube **121** and the outer air flowing tube **122** communicates with the first air inlet **114** and the second air inlet **1218**. The airflow channel **123** extends towards the top of the atomizer for a certain distance to be higher than the second air inlet **1218** and extends downwards from the top of the atomizer to communicate with the second air inlet **1218**. In some embodiments, the airflow channel **123** is formed between the outer air flowing tube **121** and the first tube section **1221**. The airflow channel **123** includes a first airflow channel extending upwards, a second airflow channel communicating with the second air inlet **1218** such that air can flow downwards, and a communication channel communicating the first airflow channel with the second airflow channel. The first airflow channel can be the first air intake slot **1216** formed in the surface of the first tube section **1211** which includes two parallel air intake sub-slots. The second airflow channel can be the second air intake slot **1217** formed in the surface of the first tube section **1211** and facing away from the first air intake slot **1216**. The communication channel can be the communication channel **1219** communicating with the first air intake slot **1216** and the second air intake slot **1217**. The communication channel **1219** is the gap formed between the first tube section **1211** and the cover **1223** by the step **1213**. With the airflow channel **123**, leakage of the e-liquid in the atomizer from the first air inlet **114** can be prevented no matter how the atomizer is placed.

It is understood that in other embodiments, the first air intake slot **1216** and the second air intake slot **1217** can be formed in an inner surface of the outer air flowing tube **122** and correspond to two sides of the inner air flowing tube **121** respectively; or, the airflow channel **123** can be an independent airflow tube arranged between the outer air flowing tube **122** and the inner air flowing tube **121**, and a section of the airflow tube extends towards the bottom of the atomizer and is higher than the second air inlet **1218**.

As shown FIG. **5**, the blocking assembly **124** includes a sealing cover **1241** and an electrode **1242** located at the center of the sealing cover **1241**. The sealing cover **1241** is configured for blocking the first tube section **1211**. The electrode **1242** abuts a positive pole of the base **11**, and one end of the electrode **1242** is connected to a positive pole of the atomization assembly **15**, thus, electricity can be conducted to supply power to the atomization assembly **15** for atomization.

Referring to FIG. **3** again, the cartridge **13** is cylindrical for cooperating with the outer wall of the outer air flowing tube **122** to form the liquid reservoir **14**. The cartridge **13** can be made of zinc alloy, aluminum alloy, stainless steel or other metal alloys. It is understood that in other embodiments, the cartridge **13** can have other shapes and can be made of plastic having a good heat resistance rather than alloy.

The cartridge **13** further forms an opening communicating the liquid reservoir **14** with the external environment and an engaging portion **141** arranged adjacent to the opening **130**. E-liquid can be injected to the atomizer through the opening **130**. The engaging portion **141** is configured for connecting to the mouthpiece assembly **20**. Two discharging holes **1210** are defined in two sides of the engaging portion **141** for holding the mouthpiece assembly **20**. In other embodiments, the discharging holes **1210** can be defined in the second tube section **1212**. Air discharges from the liquid reservoir **14** while an inserting portion **22** is being inserted into the engaging portion **141**; after the inserting portion **22** has been inserted into the engaging portion **141** in place, the discharging hole **1210** is blocked by the inserting portion **22**, thus, e-liquid in the liquid reservoir **14** can be prevented from being pushed to flow into the atomization chamber **15** and thus liquid leakage can be prevented.

Referring to FIGS. **3** and **10**, in some embodiments, the mouthpiece assembly **20** can be located on one end of the cartridge assembly **10** which is away from the base **11**. The mouthpiece assembly **20** includes an air outlet tube **21**, the inserting portion **22**, and a sealing member **23**. The air outlet tube **21** communicates with the inner air flowing tube **121** for discharging atomized smoke. The inserting portion **22** is capable being inserted into the engaging portion of the liquid reservoir **14** for blocking the opening of the liquid reservoir **14**. The sealing member **23** is configured for blocking the corresponding discharging hole **1210**. The sealing member **23** is sleeved into the inserting portion **22** for blocking the corresponding discharging hole **1210** defined in the inner air flowing tube **121**. It is understood that the sealing member **23** can be sleeved on the inserting portion **22** for blocking the corresponding discharging hole **1210** defined in the cartridge **13**. In order to facilitate the disassembly of the mouthpiece assembly **20** and the injection of the e-liquid, the mouthpiece assembly **20** can be detachably connected to the opening of the liquid reservoir **14**, for example, the mouthpiece assembly **20** can be threaded to or clamped onto the opening of the liquid reservoir **14**.

The present disclosure further provides an electronic cigarette with the above atomizer. It is understood that a

power supply can be arranged on the base **11** of the above atomizer to form the electronic cigarette of the present disclosure.

The contents described above are only preferred embodiments of the present disclosure, but the scope of the present disclosure is not limited to the embodiments. Any ordinarily skilled in the art would make any modifications or replacements to the embodiments in the scope of the present disclosure, and these modifications or replacements should be included in the scope of the present disclosure. Thus, the scope of the present disclosure should be subjected to the claims.

What is claimed is:

1. An atomizer applicable in an electronic cigarette, comprising a cartridge assembly (**10**), a mouthpiece assembly (**20**); the cartridge assembly (**10**) comprising a liquid reservoir (**14**), an opening (**130**) communicating the liquid reservoir (**14**) with an external environment, and an atomization chamber (**1214**) communicating with the liquid reservoir (**14**); the mouthpiece assembly (**20**) being inserted into the opening (**130**); wherein the cartridge assembly (**10**) comprises an engaging portion (**141**) located adjacent to the opening (**130**), the mouthpiece assembly (**20**) comprises an inserting portion (**22**) inserted into the engaging portion (**141**); the engaging portion (**141**) defines a discharging hole (**1210**) for discharging air inside the liquid reservoir (**14**) while the inserting portion (**22**) is being inserted into the engaging portion (**141**), and after the inserting portion (**22**) is inserted into the engaging portion (**141**) in place, the discharging hole (**1210**) is blocked.

2. The atomizer of claim **1**, wherein the inserting portion (**22**) is detachably inserted into the engaging portion (**141**).

3. The atomizer of claim **1**, wherein the cartridge assembly (**10**) comprises a base (**11**), an air flowing tube assembly (**12**) mounted on the base (**11**), a cartridge (**13**) sleeved on the air flowing tube assembly (**12**); and the liquid reservoir (**14**) is formed between an outer wall of the air flowing tube assembly (**12**) and an inner wall of the cartridge (**13**);

the air flowing tube assembly (**12**) comprises an inner air flowing tube (**121**), and the discharging hole (**1210**) is defined in a top of a wall of the inner air flowing tube (**121**); and the inner air flowing tube (**121**) forms the atomization chamber (**1214**);

the mouthpiece assembly (**20**) further comprises a sealing member (**23**) and an air outlet tube (**21**) communicating with the inner air flowing tube (**121**); and

the sealing member (**23**) is inserted into the inserting portion (**22**) for blocking the discharging hole (**1210**).

4. The atomizer of claim **3**, wherein the inner air flowing tube (**121**) comprises a first tube section (**1211**), a second tube section (**1212**) communicating with the mouthpiece assembly (**20**), and a step (**1213**) formed at the connection between the first tube section (**1211**) and the second tube section (**1212**); and a diameter of the second tube section (**1212**) is less than that of the first tube section (**1211**);

the discharging hole (**1210**) is defined in the second tube section (**1212**) and communicates with the second tube section (**1212**); and

the second tube section (**1212**) is inserted into the inserting portion (**22**), and the sealing member (**23**) is sleeved on the second tube section (**1212**) and corresponds to the discharging hole (**1210**).

5. The atomizer of claim **4**, wherein the air flowing tube assembly (**12**) comprises an outer air flowing tube (**122**) sleeved on the inner air flowing tube (**121**);

the outer air flowing tube (**122**) comprises a tube body (**1221**) and a cover (**1223**) located on one end of the tube body (**1221**), and a through hole (**1222**) is defined in the cover (**1223**);

the tube body (**1221**) is sleeved on the first tube section (**1211**), an inner surface of the tube body (**1221**) tightly contacts an outer surface of the first tube section (**1211**), and the second tube section (**1212**) passes through the through hole (**1222**); a bottom diameter of the tube body (**1221**) matches with that of the first tube section (**1211**), and a top diameter of the tube body (**1221**) matches with that of the second tube section (**1212**); and

the liquid reservoir (**14**) is formed between an outer surface of the tube body (**1221**) and an inner surface of the cartridge (**13**), and an airflow channel (**123**) is formed between the inner surface of the tube body (**1221**) and the outer surface of the first tube section (**1211**).

6. The atomizer of claim **5**, wherein the first tube section (**1211**) forms the atomization chamber (**1214**), and an atomization assembly (**15**) is arranged in the atomization chamber (**1214**); and

at least one liquid absorbing hole (**1215**, **1224**) is defined in the first tube section (**1211**) and the outer air flowing tube (**122**), and the liquid absorbing hole (**1215**) defined in the outer air flowing tube (**122**) corresponds to and communicate with the liquid absorbing hole (**1215**) defined in the first tube section (**1211**).

7. The atomizer of claim **6**, wherein the base (**11**) comprises a plate (**111**), a mounting portion (**112**) arranged on the plate (**111**) and extending towards a top of the atomizer, and a connecting portion (**113**) located on a bottom of the plate (**111**); and

a first air inlet (**114**) is formed in the connecting portion (**113**); the air flowing tube assembly (**12**) and the cartridge (**13**) are located on the mounting portion (**112**), and the cartridge (**13**) is sleeved on the mounting portion (**112**).

8. The atomizer of claim **7**, wherein a first air intake slot (**1216**) and a second air intake slot (**1217**) are formed on the outer surface of the first tube section (**1211**), the first air intake slot (**1216**) communicates with the first air inlet (**114**), and the second air intake slot (**1217**) faces away from the first air intake slot (**1216**); a second air inlet (**1218**) communicating with the inner air flowing tube (**121**) is formed in the second air intake slot (**1217**); the step (**1213**) supports the cover (**1223**), and a gap between the first tube section (**1211**) and a top of the cover (**1223**) forms a communication channel (**1219**) communicating the first air intake slot (**1216**) with the second air intake slot (**1217**); and

the airflow channel (**123**) comprises the first air intake slot (**1216**), the second air intake slot (**1217**), and the communication channel (**1219**).

9. The atomizer of claim **6**, wherein a blocking assembly (**124**) is arranged on one end of the first tube section (**1211**) adjacent to the base (**11**) for blocking the inner air flowing tube (**121**).

10. The atomizer of claim **9**, wherein the blocking assembly (**124**) comprises a sealing cover (**1241**) and an electrode (**1242**) located at the center of the sealing cover (**1241**); and

the electrode (**1242**) abuts a positive pole of the base (**11**), a positive pole of the atomization assembly (**15**) is connected to the electrode (**1242**), and a negative pole of the atomization assembly (**15**) is connected to a negative pole of the base (**11**) through the outer air flowing tube (**122**) and the inner air flowing tube (**121**).

11. An electronic cigarette comprising an atomizer, the atomizer comprising a cartridge assembly (10), a mouthpiece assembly (20); the cartridge assembly (10) comprising a liquid reservoir (14), an opening (130) communicating the liquid reservoir (14) with an external environment, and an atomization chamber (1214) communicating with the liquid reservoir (14); the mouthpiece assembly (20) being inserted into the opening (130); wherein the cartridge assembly (10) comprises an engaging portion (141) located adjacent to the opening (130), the mouthpiece assembly (20) comprises an inserting portion (22) inserted into the engaging portion (141); the engaging portion (141) defines a discharging hole (1210) for discharging air inside the liquid reservoir (14) while the inserting portion (22) is being inserted into the engaging portion (141), and after the inserting portion (22) is inserted into the engaging portion (141) in place, the discharging hole (1210) is blocked.

12. The electronic cigarette of claim 11, wherein the inserting portion (22) is detachably inserted into the engaging portion (141).

13. The electronic cigarette of claim 11, wherein the cartridge assembly (10) comprises a base (11), an air flowing tube assembly (12) mounted on the base (11), a cartridge (13) sleeved on the air flowing tube assembly (12); and the liquid reservoir (14) is formed between an outer wall of the air flowing tube assembly (12) and an inner wall of the cartridge (13);

the air flowing tube assembly (12) comprises an inner air flowing tube (121), and the discharging hole (1210) is defined in a top of a wall of the inner air flowing tube (121); and the inner air flowing tube (121) forms the atomization chamber (1214);

the mouthpiece assembly (20) further comprises a sealing member (23) and an air outlet tube (21) communicating with the inner air flowing tube (121); and

the sealing member (23) is inserted into the inserting portion (22) for blocking the discharging hole (1210).

14. The electronic cigarette of claim 13, wherein the inner air flowing tube (121) comprises a first tube section (1211), a second tube section (1212) communicating with the mouthpiece assembly (20), and a step (1213) formed at the connection between the first tube section (1211) and the second tube section (1212); and a diameter of the second tube section (1212) is less than that of the first tube section (1211);

the discharging hole (1210) is defined in the second tube section (1212) and communicates with the second tube section (1212); and

the second tube section (1212) is inserted into the inserting portion (22), and the sealing member (23) is sleeved on the second tube section (1212) and corresponds to the discharging hole (1210).

15. The electronic cigarette of claim 14, wherein the air flowing tube assembly (12) comprises an outer air flowing tube (122) sleeved on the inner air flowing tube (121);

the outer air flowing tube (122) comprises a tube body (1221) and a cover (1223) located on one end of the tube body (1221), and a through hole (1222) is defined in the cover (1223);

the tube body (1221) is sleeved on the first tube section (1211), an inner surface of the tube body (1221) tightly contacts an outer surface of the first tube section (1211), and the second tube section (1212) passes through the through hole (1222); a bottom diameter of the tube body (1221) matches with that of the first tube section (1211), and a top diameter of the tube body (1221) matches with that of the second tube section (1212); and

the liquid reservoir (14) is formed between an outer surface of the tube body (1221) and an inner surface of the cartridge (13), and an airflow channel (123) is formed between the inner surface of the tube body (1221) and the outer surface of the first tube section (1211).

16. The electronic cigarette of claim 15, wherein the first tube section (1211) forms the atomization chamber (1214), and an atomization assembly (15) is arranged the atomization chamber (1214); and

at least one liquid absorbing hole (1215, 1224) is defined in the first tube section (1211) and the outer air flowing tube (122), and the liquid absorbing hole (1215) defined in the outer air flowing tube (122) corresponds to and communicate with the liquid absorbing hole (1215) defined in the first tube section (1211).

17. The electronic cigarette of claim 16, wherein the base (11) comprises a plate (111), a mounting portion (112) arranged on the plate (111) and extending towards a top of the atomizer, and a connecting portion (113) located on a bottom of the plate (111); and

a first air inlet (114) is formed in the connecting portion (113); the air flowing tube assembly (12) and the cartridge (13) are located on the mounting portion (112), and the cartridge (13) is sleeved on the mounting portion (112).

18. The electronic cigarette of claim 17, wherein a first air intake slot (1216) and a second air intake slot (1217) are formed on the outer surface of the first tube section (1211), the first air intake slot (1216) communicates with the first air inlet (114), and the second air intake slot (1217) faces away from the first air intake slot (1216); a second air inlet (1218) communicating with the inner air flowing tube (121) is formed in the second air intake slot (1217); the step (1213) supports the cover (1223), and a gap between the first tube section (1211) and a top of the cover (1223) forms a communication channel (1219) communicating the first air intake slot (1216) with the second air intake slot (1217); and

the airflow channel (123) comprises the first air intake slot (1216), the second air intake slot (1217), and the communication channel (1219).

19. The electronic cigarette of claim 16, wherein a blocking assembly (124) is arranged on one end of the first tube section (1211) adjacent to the base (11) for blocking the inner air flowing tube (121).

20. The atomizer of claim 19, wherein the blocking assembly (124) comprises a sealing cover (1241) and an electrode (1242) located at the center of the sealing cover (1241); and

the electrode (1242) abuts a positive pole of the base (11), a positive pole of the atomization assembly (15) is connected to the electrode (1242), and a negative pole of the atomization assembly (15) is connected to a negative pole of the base (11) through the outer air flowing tube (122) and the inner air flowing tube (121).

* * * * *

US00D817544S

(12) **United States Design Patent** (10) **Patent No.: US D817,544 S**
Chen (45) **Date of Patent: ** May 8, 2018**

(54) **ATOMIZER FOR ELECTRONIC CIGARETTE**

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(**) Term: **15 Years**

(21) Appl. No.: **29/606,428**

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(51) **LOC (11) Cl.** **27-02**

(52) **U.S. Cl.**
USPC **D27/167**

(58) **Field of Classification Search**
USPC D27/101, 106, 108, 163, 165, 169, 172, D27/174, 175, 183, 186–190, 193, 195, D27/131, 141, 142, 152, 153, 160; D24/110; 131/273, 274, 191, 328–330; 128/202.21, 203.12
CPC A24F 47/002; A24F 47/004; A24F 47/006; A24F 47/008; A61M 15/06
See application file for complete search history.

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D780,372	S	*	2/2017	Liu	D27/101
D783,117	S	*	4/2017	Gilbarte	D22/117
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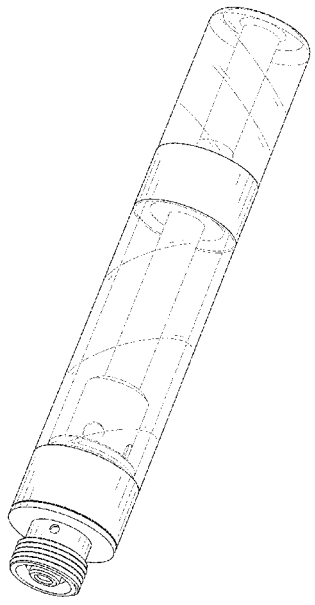
(57) **CLAIM**

The ornamental design for an atomizer for electronic cigarette, as shown and described.

DESCRIPTION

FIG. **1** is a front elevational view of an atomizer for electronic cigarette showing my new design;
FIG. **2** is a rear elevational view thereof;
FIG. **3** is a left side elevational view thereof;
FIG. **4** is a right side elevational view thereof;
FIG. **5** is a top plan view thereof;
FIG. **6** is a bottom plan view thereof;
FIG. **7** is a perspective view thereof; and,
FIG. **8** is another perspective view thereof.

1 Claim, 8 Drawing Sheets



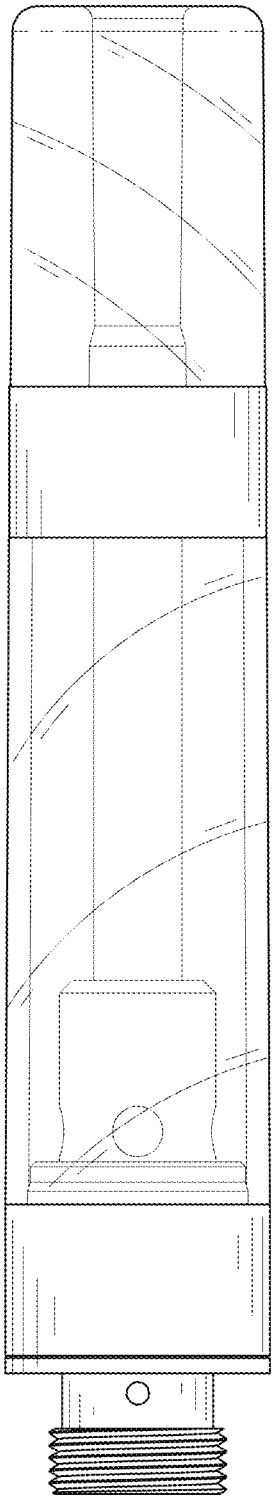


FIG. 1

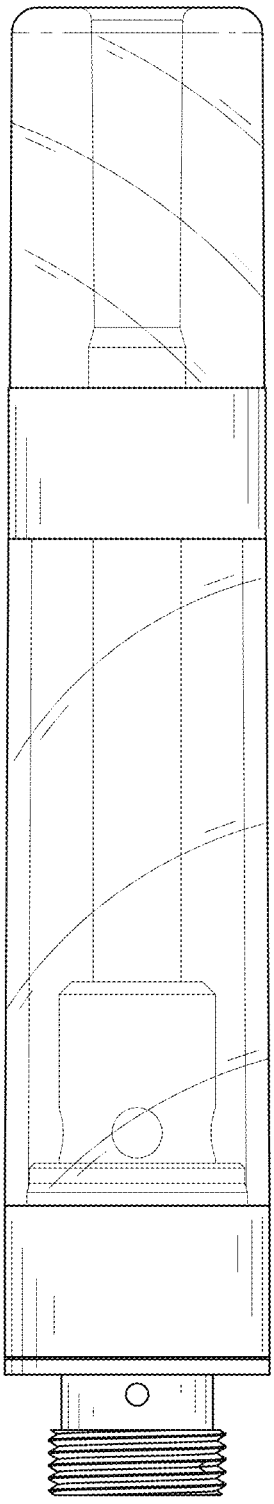


FIG. 2

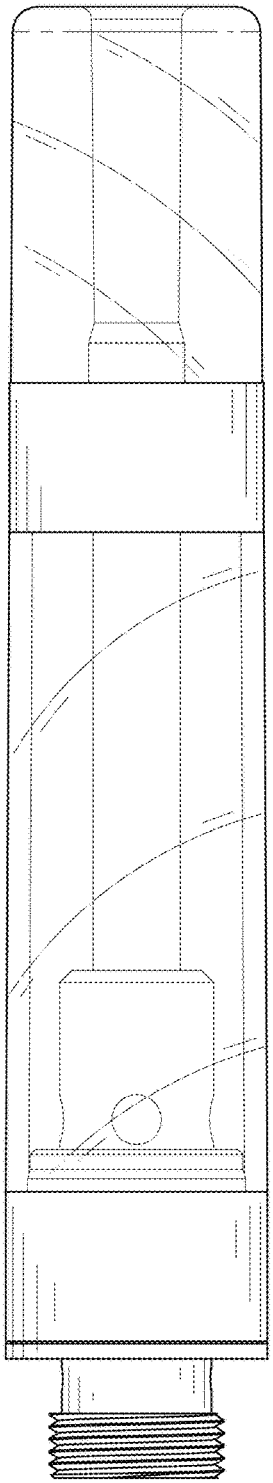


FIG. 3

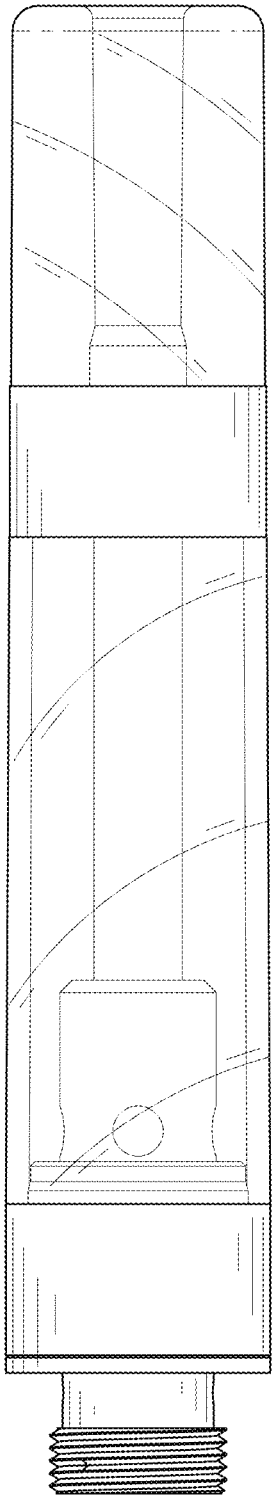


FIG. 4

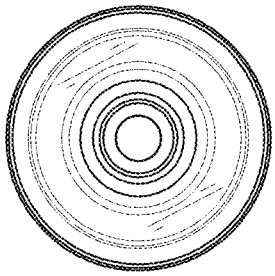


FIG. 5

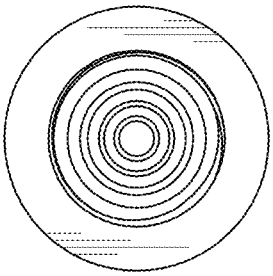


FIG. 6

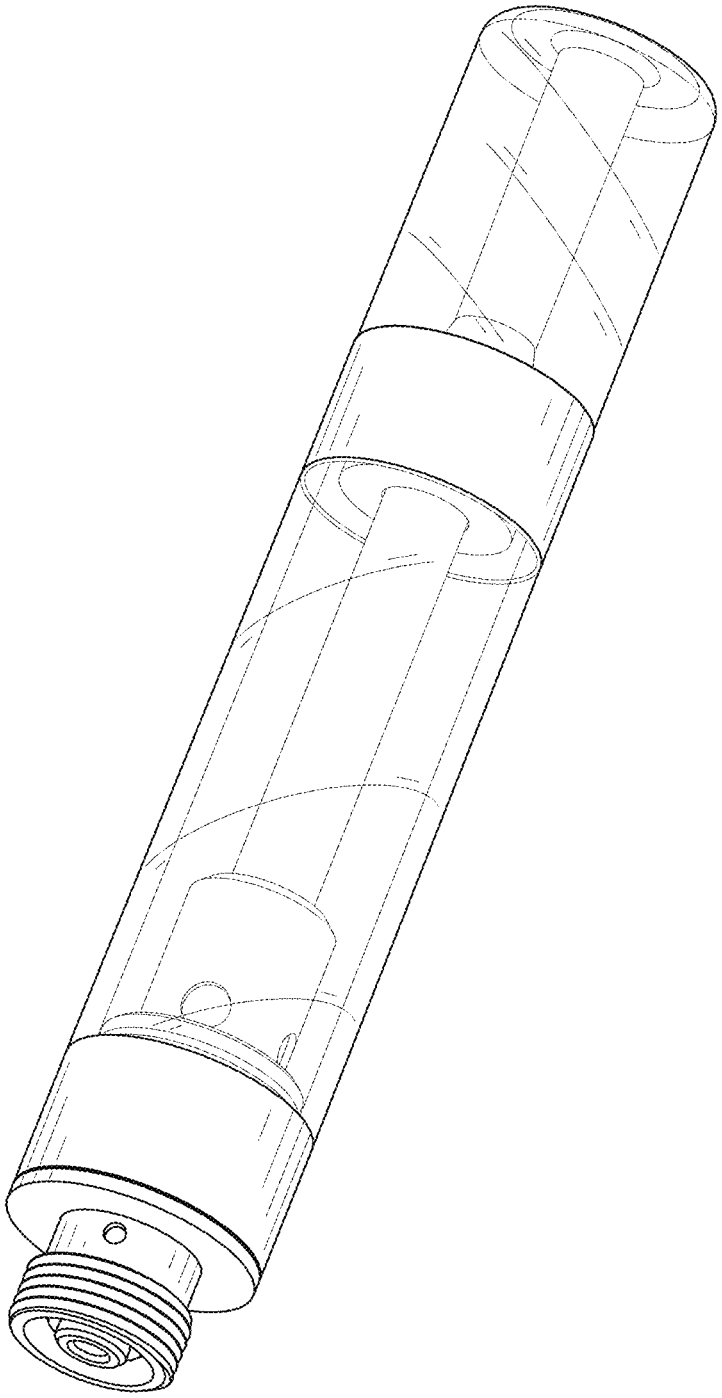


FIG. 7

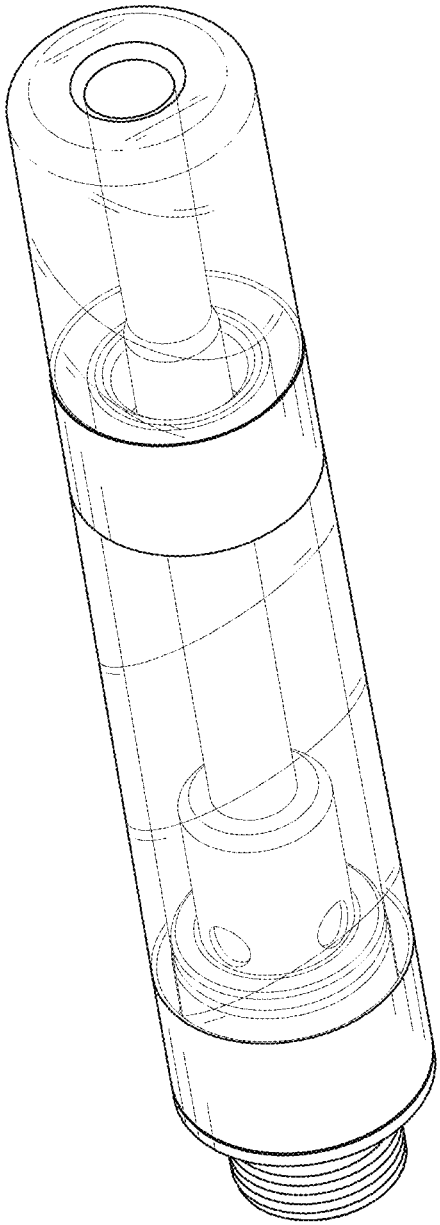


FIG. 8

US00D823534S

(12) **United States Design Patent** (10) **Patent No.: US D823,534 S**
Chen (45) **Date of Patent: ** Jul. 17, 2018**

(54) **ATOMIZER FOR ELECTRONIC CIGARETTE**

(71) Applicant: **SHENZHEN SMOORE TECHNOLOGY LIMITED**, Shenzhen (CN)

(72) Inventor: **Zhiping Chen**, Shenzhen (CN)

(73) Assignee: **SHENZHEN SMOORE TECHNOLOGY LIMITED**, Shenzhen (CN)

(**) Term: **15 Years**

(21) Appl. No.: **29/606,439**

(22) Filed: **Jun. 5, 2017**

(30) **Foreign Application Priority Data**

Feb. 23, 2017 (CN) 2017 3 0049067

(51) **LOC (11) Cl.** **27-02**

(52) **U.S. Cl.**
USPC **D27/162**

(58) **Field of Classification Search**
USPC D27/101, 106, 108, 163, 165, 169, 172, D27/174, 175, 183, 186–190, 193, 195, D27/131, 141, 142, 152, 153, 160; D24/110; 131/273, 274, 191, 328–330; 128/202.21, 203.12
CPC A24F 47/002; A24F 47/004; A24F 47/006; A24F 47/008; A61M 15/06
See application file for complete search history.

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D783,117	S	*	4/2017	Gilbarte	D22/117
D792,022	S	*	7/2017	Li	D27/167
D806,943	S	*	1/2018	Liu	D27/101
D811,652	S	*	2/2018	Liu	D27/167
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Primary Examiner — Susan Bennett Hattan
Assistant Examiner — Rebecca Tsehaye
(74) *Attorney, Agent, or Firm* — Ladas & Parry LLP

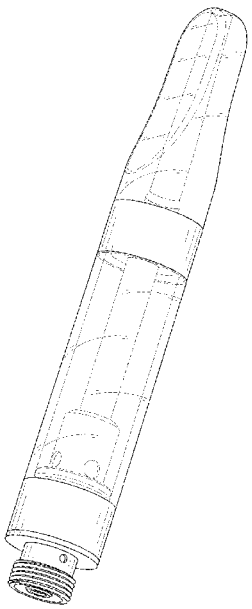
(57) **CLAIM**

The ornamental design for an atomizer for electronic cigarette, as shown and described.

DESCRIPTION

FIG. **1** is a front elevational view of an atomizer for electronic cigarette showing my new design;
FIG. **2** is a rear elevational view thereof;
FIG. **3** is a left side elevational view thereof;
FIG. **4** is a right side elevational view thereof;
FIG. **5** is a top plan view thereof;
FIG. **6** is a bottom plan view thereof;
FIG. **7** is a perspective view thereof; and,
FIG. **8** is another perspective view thereof.

1 Claim, 8 Drawing Sheets



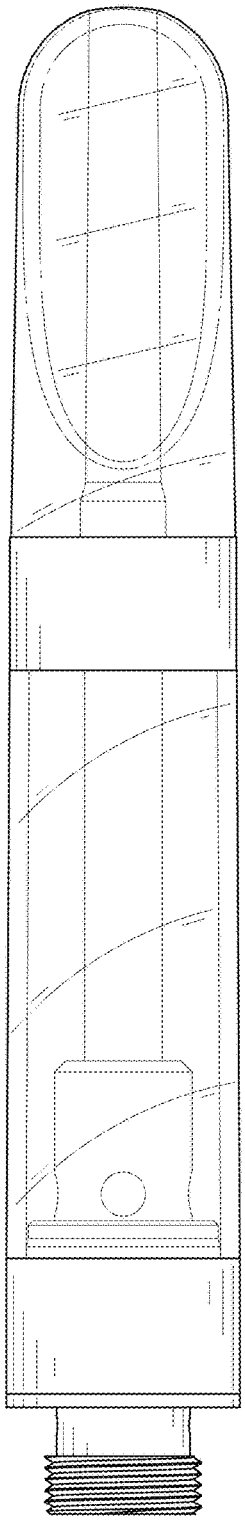


FIG. 1

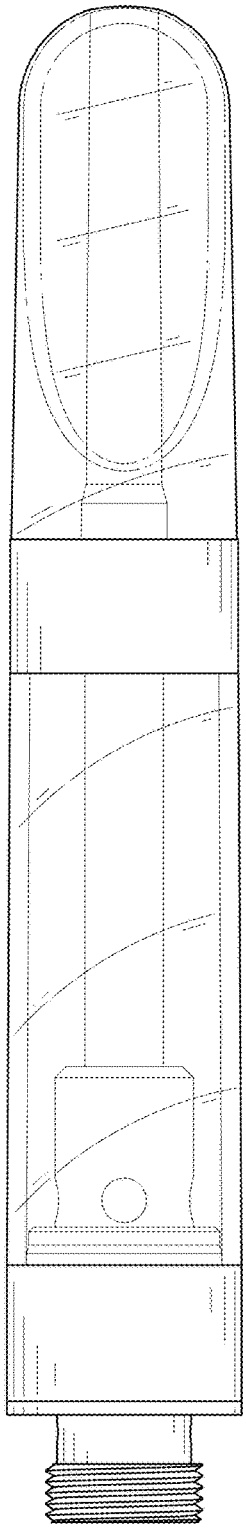


FIG. 2

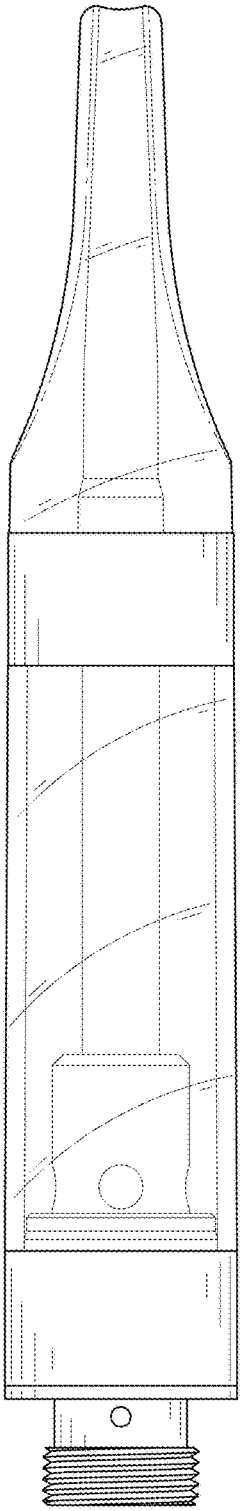


FIG. 3

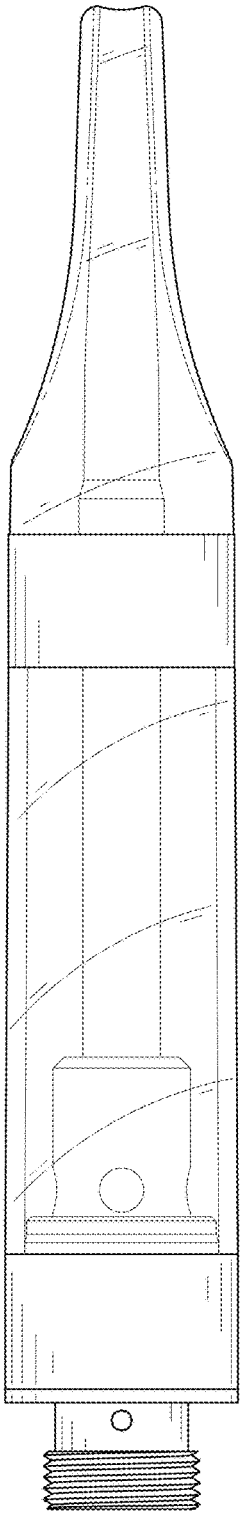


FIG. 4

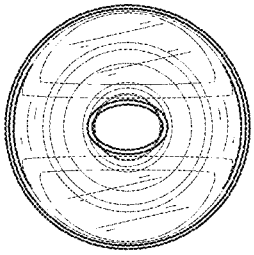


FIG. 5

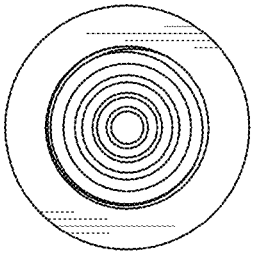


FIG. 6

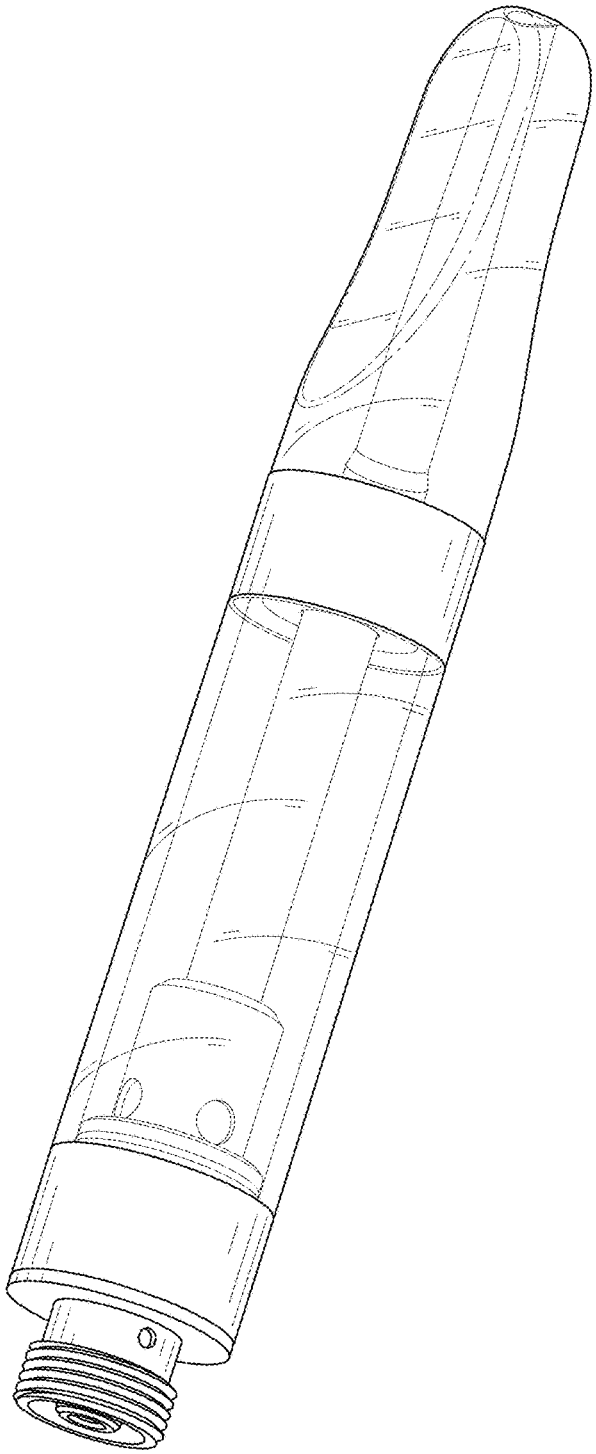


FIG. 7

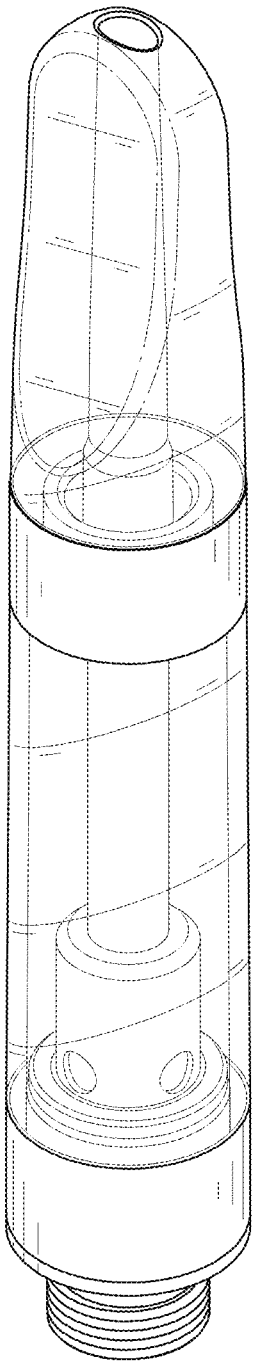


FIG. 8

US00D853635S

(12) United States Design Patent

Chen

(10) Patent No.: US D853,635 S
(45) Date of Patent: ** Jul. 9, 2019

(54) **ATOMIZER FOR ELECTRONIC CIGARETTE**

(71) Applicant: **SHENZHEN SMOORE TECHNOLOGY LIMITED**, Shenzhen (CN)

(72) Inventor: **Zhiping Chen**, Shenzhen (CN)

(73) Assignee: **SHENZHEN SMOORE TECHNOLOGY LIMITED**, Shenzhen (CN)

(**) Term: **15 Years**

(21) Appl. No.: **29/606,450**

(22) Filed: **Jun. 5, 2017**

(30) **Foreign Application Priority Data**

Feb. 23, 2017 (CN) 2017 3 0049185

(51) **LOC (11) Cl.** **27-99**

(52) **U.S. Cl.**
USPC **D27/194**

(58) **Field of Classification Search**
USPC D27/100, 101, 139–161, 162–194; D23/366; D7/416
CPC A24F 47/008; A24F 47/002; A24F 7/00; A24F 15/12
See application file for complete search history.

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Primary Examiner — Marissa J Cash
(74) *Attorney, Agent, or Firm* — Ladas & Parry LLP

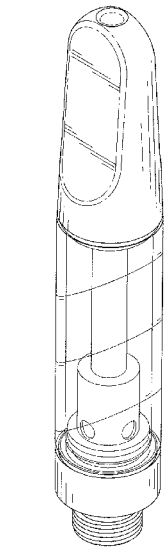
(57) **CLAIM**

The ornamental design for an atomizer for electronic cigarette, as shown and described.

DESCRIPTION

FIG. **1** is a front elevational view of an atomizer for electronic cigarette showing my new design;
FIG. **2** is a rear elevational view thereof;
FIG. **3** is a left side elevational view thereof;
FIG. **4** is a right side elevational view thereof;
FIG. **5** is a top plan view thereof;
FIG. **6** is a bottom plan view thereof;
FIG. **7** is a perspective view thereof; and,
FIG. **8** is another perspective view thereof.
The broken lines in the drawings depict portions of the atomizer for electronic cigarette that form no part of the claimed design.

1 Claim, 8 Drawing Sheets



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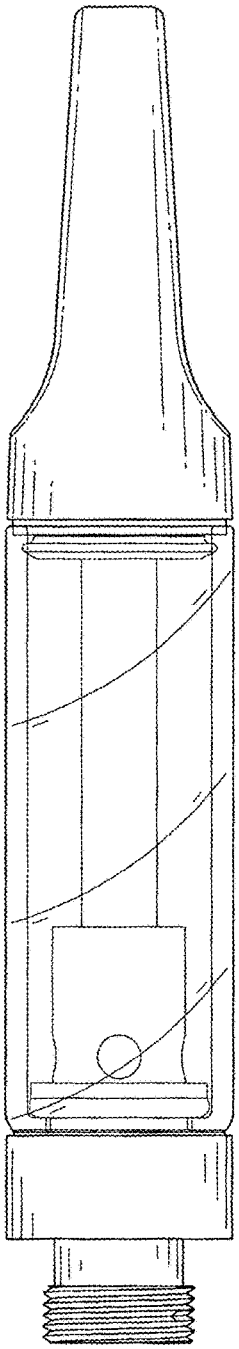

FIG. 1

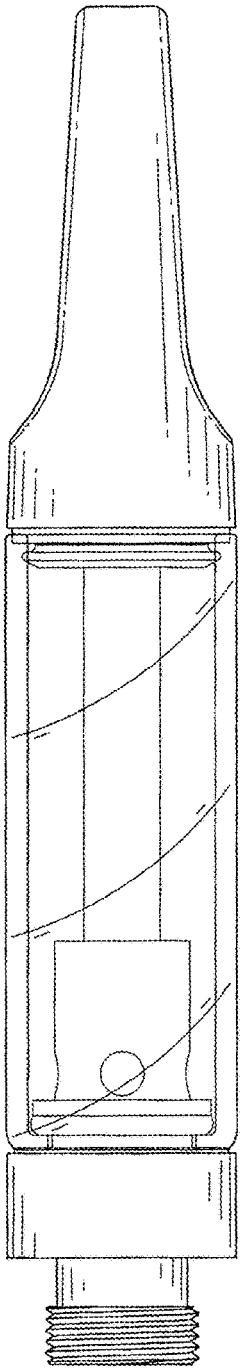

FIG. 2

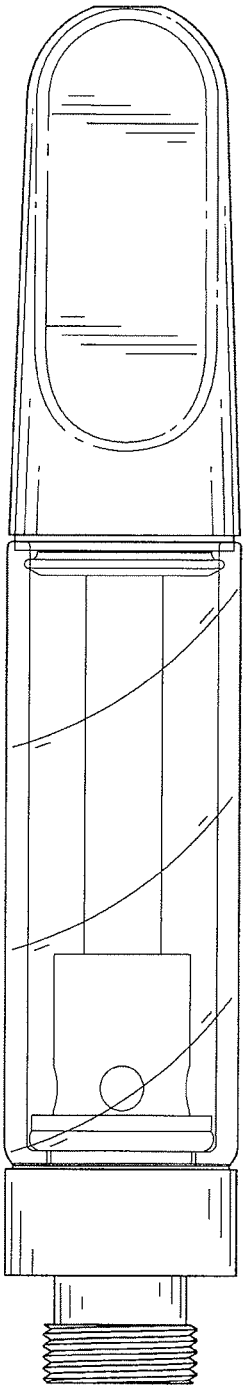

FIG. 3

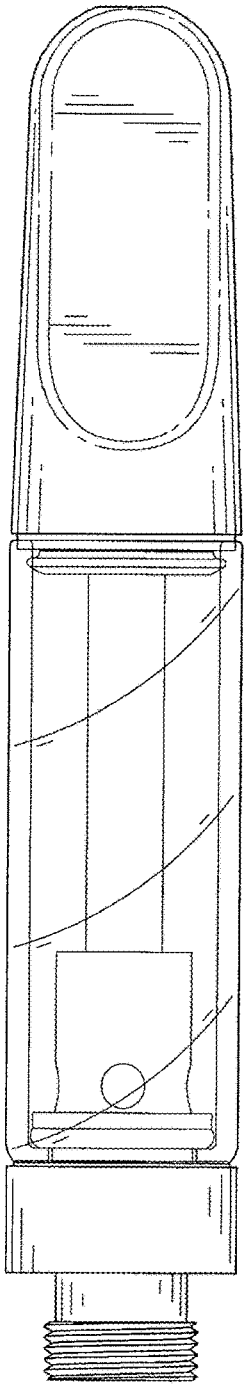

FIG. 4

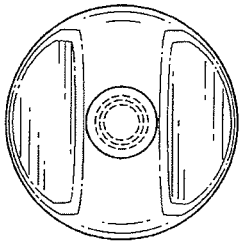

FIG. 5

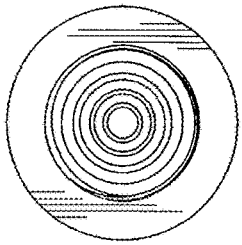

FIG. 6

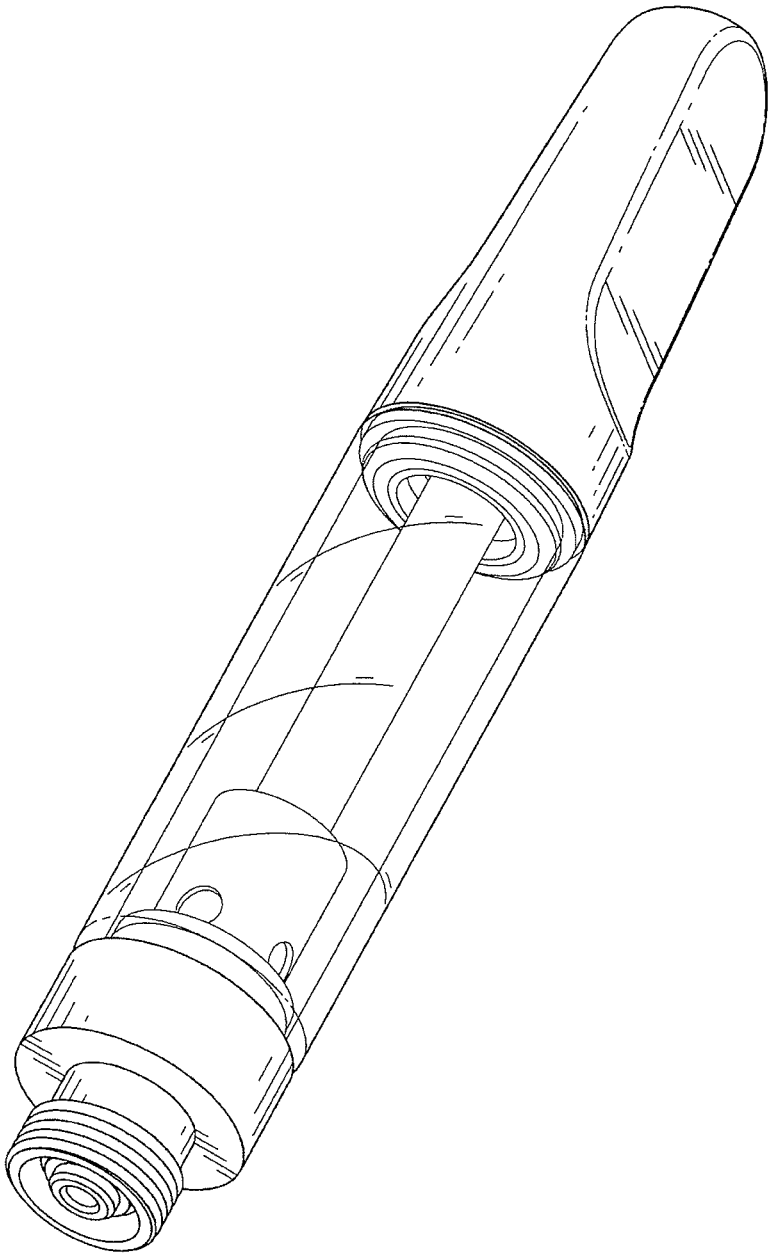

FIG. 7

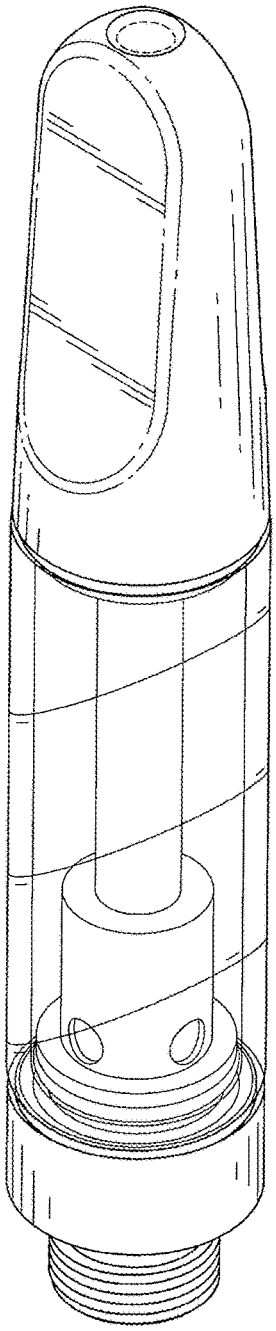

FIG. 8